

WSRC-RP-2004-00256

Savannah River Site Annual Meteorology Report for 2003 (U)

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U. S. Department of Energy under contract no. DE-AC09-96SR18500

This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-96SR18500 with the U. S. Department of Energy.

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This report has been reproduced directly from the best available copy.

Available for sale to the public, in paper, from: U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161,
phone: (800) 553-6847,
fax: (703) 605-6900
email: orders@ntis.fedworld.gov
online ordering: <http://www.ntis.gov/help/index.asp>

Available electronically at <http://www.osti.gov/bridge>
Available for a processing fee to U.S. Department of Energy and its contractors, in paper, from: U.S. Department of Energy, Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831-0062,
phone: (865)576-8401,
fax: (865)576-5728
email: reports@adonis.osti.gov

WSRC-RP-2004-00256

Savannah River Site Annual Meteorology Report for 2003 (U)

C. H. Hunter

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Prepared for the U. S. Department of Energy under contract no. DE-AC09-96SR18500

Contents

Summary	1
Background	2
The General SRS Climate	2
Overview of Meteorological Monitoring at the Savannah River Site	2
Data Sources for the 2003 Report	3
The SRS Climatology for 2003	5
Overview	5
Temperature	5
Precipitation	6
Atmospheric Moisture	6
Heat Stress	7
Wind	7
Barometric Pressure	7
Solar Radiation	8
References	9
Appendix A	32

List of Tables**Table 1. Means and Extremes for 2003**

- (a) Temperature and Precipitation
- (b) Dew Point, Wet Bulb, Relative Humidity, and Wet Bulb Globe Temperature
- (c) Wind Speed, Barometric Pressure, Solar Radiation, and Heating / Cooling Degree Days

Table 2. Monthly and Annual Average and Extreme Temperatures, 1973-2003**Table 3. Monthly and Annual Average and Extreme Rainfall, 1973-2003****Table 4. Monthly and Annual Rainfall, Manual Gauges****Table A Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Wind Speed Category, 2003**

- A.1 A Area Tower
- A.2 C Area Tower
- A.3 D Area Tower
- A.4 F Area Tower
- A.5 H Area Tower
- A.6 K Area Tower
- A.7 L Area Tower
- A.8 P Area Tower
- A.9 2m Level Central Climatology Tower
- A.10 18m Level Central Climatology Tower
- A.11 36m Level Central Climatology Tower
- A.12 61m Level Central Climatology Tower
- A.13 61m Level Central Climatology Tower, Winter
- A.14 61m Level Central Climatology Tower, Spring
- A.15 61m Level Central Climatology Tower, Summer
- A.16 61m Level Central Climatology Tower, Fall

List of Figures

Figure 1. Meteorological Monitoring Stations

Figure 2. Summary of Daily Data for 2003

Figure 3. Daily High and Low Temperatures for 2003

Figure 4. SRS Annual Average Temperature 1973-2003

Figure 5. SRS Monthly Average Temperature

Figure 6. Number of Freezing (<32F) and Sweltering (>90F) Days

Figure 7. Daily Precipitation for 2003

Figure 8. SRS Annual Precipitation 1973-2003

Figure 9. SRS Monthly Precipitation

Figure 10. Daily High and Low Humidity for 2003

Figure 11. SRS Annual Average Humidity 1973-2003

Figure 12. SRS Monthly Average Minimum Humidity

Figure 13. Daily Average Wind Speed for 2003

Figure 14. Annual Wind Rose Plots for 2003, 61m Level

(a) A, C, D, and F Area Towers

(b) H, K, L, and P Area Towers

Figure 15. Annual Wind Rose Plots for 2003, Central Climatology Tower, All Levels

Figure 16. Seasonal Wind Rose Plots for 2003, Central Climatology Tower, 61m Level

Figure 17. Daily Average Barometric Pressure for 2003

Figure 18. Daily Total Solar Radiation for 2003

Summary

Summaries of meteorological observations collected at the Savannah River Site in 2003 reveal a year that was unusually cool and wet. The annual rainfall of 61.2 inches was the third highest of all the years in a period of record that began in 1952. Higher amounts were recorded only in 1964 (73.5 in) and 1971 (68.2 in). Rainfall of 0.01 inch or more occurred on 119 days during the year.

Furthermore, the annual average temperature of 62.2 °F was the coldest of any year in an available record that dates to 1964. Cool and wet conditions were most pronounced in the spring and summer months. Unusually cold weather also occurred in January and December.

The coldest temperature for the year was 12.5 °F (Jan 24) and the warmest temperature was 92.4 °F (Aug 27).

There were no significant occurrences of severe weather (ice/snow, tornado, sustained high wind) during the year. The heavy rain that occurred on April 7 (3.5 inches) was due to an active stationary front over the area and strong southwesterly wind aloft. The remnants of Tropical Storm Bill produced 2.36 inches of rain on July 1. Hurricane Isabelle, which struck the North Carolina coast mid September, did not have a significant affect on the SRS. A thunderstorm on May 3 produced a surface (4-meter) wind gust of 41.7 miles per hour.

Background

The General SRS Climate

The Savannah River Site region has a humid subtropical climate characterized by relatively short, mild winters and long, warm, and humid summers (Oliver and Fairbridge, 1987).

Summer-like conditions typically last from May through September, when the area is frequently under the influence of the western extension of the semi-permanent Atlantic subtropical anticyclone (i.e. the 'Bermuda' high). Winds in summer are light and cold fronts generally remain well north of the area. Daily high temperatures during the summer months exceed 90°F on more than half of all days on the average. Scattered afternoon and evening thunderstorms are common.

The influence of the Bermuda high begins to diminish during the fall, resulting in lower humidity and more moderate temperatures. Average rainfall during the fall is usually the least of the four seasons.

In the winter months, mid-latitude low pressure systems and associated fronts often migrate through the region. As a result, conditions frequently alternate between warm, moist, subtropical air from the Gulf of Mexico region and cool, dry polar air. The Appalachian Mountains to the north and northwest of the SRS help to moderate the extremely cold temperatures associated with occasional outbreaks of Arctic air. Consequently, less than one-third of winter days have minimum temperatures below freezing on average, and days with temperatures below 20°F are infrequent. Measurable snowfall is rare.

Tornadoes and severe thunderstorms occur more frequently in spring than in other seasons of the year. Although spring weather is somewhat windy, temperatures are usually mild and humidity is relatively low.

Overview of the Savannah River Site Meteorological Monitoring Program

Meteorological data are collected at SRS from a network of nine primary monitoring stations (Fig. 1). Towers located adjacent to each of eight primary operations areas (A, C, D, F, H, K, L, and P areas) are equipped to measure wind direction, wind speed, temperature, and dew point at a height of 61 meters (m) above ground. Temperature and dew point are also measured at 2m. A ninth tower near N-Area, known as the Central Climatology site (CLM), is instrumented with wind, temperature, and dew point sensors at four levels: 2m (4m for wind), 18m, 36m, and 61m. The CLM site is also equipped with an automated tipping bucket rain gauge, a barometric pressure sensor, and a solar radiometer near the tower at ground level. Data acquisition units at each station record a measurement from each instrument at 1-second intervals. Every 15 minutes, the 1-second data are processed to generate statistical summaries for each variable, including averages and instantaneous maxima, and the results uploaded to a relational database for archival. All aspects of the meteorological data collection program meet or exceed applicable regulatory criteria. Parker and Addis (1993) provide a complete description of the meteorological monitoring program at SRS.

Quality assurance of the data is conducted in two phases: an initial screening of recent

data, followed by an in-depth review and final quality classification. The initial screening, performed twice daily by qualified instrument technicians, consists of a thorough examination of 15-minute data retrieved from the database, in conjunction with a summary of instrument diagnostics obtained from the local data acquisition units. Potential problems are noted in a daily checksheet and, as needed, data acquisition unit software is instructed to assign a quality control tag to data collected from questionable instruments. Quality tags are also set during periods of calibration and maintenance.

The second phase of the quality assurance process is conducted according to formal procedure (SRTC, 2003). Daily checksheets generated during the initial screening, tower-specific logbook entries, initial quality tags, and time series plots of related data are reviewed to determine a final quality status for each record. All records permanently archived in the data base are identified as good, fatal, intermittent, biased, or uncalibrated.

A major initiative to port all meteorological data base operations to a UNIX server was completed in 2003. The data base system had previously operated on a VMS computer cluster.

Additional Measurements

Additional precipitation measurements are collected from a network of 12 plastic wedge rain gauges across the SRS (See Fig. 1). These gauges are read manually by security personnel once per day, usually around 6 am. The daily data are reported to the SRS Atmospheric Technologies Center, reviewed to correct obvious flaws, and manually entered into an electronic data base table residing on the UNIX server.

Additional measurements of temperature and relative humidity are recorded from a station located in A-Area, adjacent to 773-A. This station consists of a standard National Weather Service 'cotton region' instrument shelter. Data collected from this station are manually tabulated for archival as daily high and low values of temperature and relative humidity. Tabulated values are then entered into an electronic data base table on the UNIX server.

Data Sources for the 2003 Report

Data summaries for this report were chosen to give a general overview of climatological conditions for SRS.

Specific summaries are provided for:

- Ground level measurements of *temperature (2m)*, *dew point temperature (2m)*, *wind speed (4m)*, *precipitation*, *barometric pressure*, and *solar radiation* from CLM, as well as meteorological quantities derived from these primary data, such as *relative humidity* (temperature and dew point), *wet bulb temperature* (temperature and dew point), *wet bulb globe temperature* (temperature, dew point, wind speed, and solar radiation), and *cooling/heating degree days* (temperature).
- Joint occurrence frequencies of wind speed and direction from measurements taken at each of the four levels of the CLM tower and the 61m level of the eight area towers.
- Precipitation from the network of manually-read rain gauges

A series of SAS software programs were used to extract the desired data sets from

the data base and perform initial statistical processing on all records with a QA status of 'good'. More than 99% of the 2003 data used in this report met this criterion. Output from the initial processing was then imported into an Excel spreadsheet to generate the final summaries that are presented in the report.

Long-term climatological records are available for temperature, precipitation, and relative humidity. Statistics generated from these data are used for comparisons with the 2003 summaries.

Available temperature and relative humidity records begin in 1964. From 1964-1995, climatological statistics used in this report were based on the record of daily high and low values recorded at the 773-A instrument shelter. After 1995, these statistics were based on the continuous record of 15-minute data from the 2m level of CLM.

Precipitation data are available from 1952. For the period 1952 through 1995, climatological statistics used in the report were based on the daily observations from the 773-A rain gauge. Summaries after 1995 were based on the automated 15-minute records collected from the CLM rain gauge. In June 2003, apparent discrepancies were noted between monthly precipitation totals that had been generated using 773-A data from the relational database and totals published in other sources. Following a detailed investigation (Parker and Antonicelli, 2003), several problem areas were identified (most notably during the period 1965 through 1981) and a corrected electronic record was produced.

Climatology of the SRS for 2003

Overview

Meteorological data summaries for 2003 indicate that weather conditions at SRS during the year were generally colder and wetter than long-term averages. Total annual precipitation of 61.2 inches was the third highest amount over all years in the available period of record. Higher totals were observed in 1964 (73.5 in) and 1971 (68.2 in). Furthermore, the annual average temperature of 62.2°F was the coldest of any year in the available historical record.

An annual average temperature of 62.2°F was also observed in 1996. An annual temperature of 62.5 °F was observed in 2000 and 1981.

Cool and wet conditions were most pronounced in the spring and summer months. Unusually cold weather also occurred in January and December. A summary plot of 2003 daily observations of temperature, precipitation, relative humidity, and wind speed is given in Fig. 2.

These conditions are consistent with regional observations. Monthly climatological discussions published by the National Weather Service, Climate Prediction Center (CPC), indicate that the cool and wet weather observed throughout much of the Southeastern U. S. for January through April was due to the ongoing presence of El Nino conditions over the tropical Pacific Ocean. Hemispheric circulation patterns during El Nino feature an active subtropical jet over the southern U.S. with strong southwest to westerly winds aloft. This results in the frequent development of low pressure systems which move through the Southeast producing persistent cloudiness and ample rain.

Although the El Nino had largely dissipated by late spring, cool and wet conditions continued through the summer as a persistent upper-level low pressure trough developed over the Eastern U.S. Weak cool fronts were able to penetrate into the Southeast on several occasions. This upper low, combined with moist southerly flow from a Bermuda high located in a position off the Southeast U.S. coast, lead to enhanced development of afternoon and evening thunderstorm activity.

The upper level trough began to amplify during September and October. West to northwest flow on the southwestern flank of the trough enabled the frequent transport of cool, dry polar air masses into the area. Warmer weather returned in November as the upper trough position shifted westward and allowed an Atlantic subtropical ridge to build over the lower Southeast. The upper trough returned to a position along the east coast on several occasions in December, accompanied by a strong polar jet that was responsible for outbreaks of cold polar air from Canada (NOAA, 2003a and 2003b).

Temperature

Monthly and annual average and daily extreme temperatures for 2003 are summarized in Table 1(a). Similar statistics for a 30-year climatological reference period (1973-2002) are given in Table 2. A plot of observed daily high and low temperatures for 2003 is shown in Fig. 3. Plots of annual average temperature, monthly average daily high and low temperature, and days exceeding critical temperature thresholds (<32°F, >90°F) for 2003 and the 30-year climatology are shown in figures 4, 5, and 6, respectively.

The annual average temperature of 62.2 °F was 2.4 degrees below the 30-year average and was the coldest annual average temperature for any year in the full period of record that dates to 1964. Monthly averages for 2003 were below their respective climatological values for all months in the year except March and November. Furthermore, monthly averages for April, June, July, September, and December all ranked among the five coldest months on record. Temperatures above 90°F occurred on a total of only seventeen days during the year and only one-fourth of days in July and August. Temperature extremes ranged from 12.5 °F on January 24 to 92.4 °F on August 27. Daily low temperature records were set on January 18, 25, and 26, March 31, and September 29.

Monthly and annual total heating and cooling degree days (based on a reference temperature of 65°F) are summarized in Table 1(c). The colder than average temperatures that occurred in 2003 resulted in a higher annual total heating degree days and a lower annual total cooling degree days than were observed over the last several years.

Precipitation

Annual, monthly, and daily total rainfall statistics for 2003 are summarized in Table 1(a). Monthly and annual rainfall totals for the 30-year climatology (1973-2002) are given in Table 3. Monthly and annual rainfall totals for the 12 plastic wedge gauges are summarized in Table 4. A plot of daily total rainfall (midnight to midnight) for the CLM site for 2003 is shown as Fig. 7. Annual and monthly rainfall for 2003 and the 30-year reference period are shown in figures 8 and 9, respectively.

Total precipitation at the CLM site, 61.18 inches, was nearly 12 inches greater than the 30-year average and resulted in the third wettest year over the 51 years of available data. Higher totals were observed in 1964 (73.5 in) and 1971 (68.2 in). Much of the annual surplus was due to rainfall occurring over the months March through July. Monthly totals for April and June were the highest and second highest totals on record for those months, respectively. The heavy rain that occurred on April 7 (3.5 in) was due to an active stationary front over the area and strong southwesterly winds aloft. The remnants of Tropical Storm Bill produced 2.36 in of rain on July 1. Measurable precipitation (>0.01 inch) occurred on 119 days and rainfall greater than 0.5 inch occurred on 42 days. The total number of rain days was much higher in 2003 than for the previous several years.

Atmospheric Moisture

Monthly and annual average and daily extreme dew point temperature, wet bulb temperature, and relative humidity for 2003 are summarized in Table 1(b). This table also presents monthly and annual average daily maximum and minimum humidity. A plot of daily maximum and minimum humidity for 2003 is shown in Fig. 10. Plots of annual average humidity for 2003 and the 30-year climatology (1973-2002) and monthly average daily minimum humidity are shown in figures 11 and 12, respectively.

Average relative humidity for 2003 was 70 percent with an average daily minimum of 48 percent and an average daily maximum of 87 percent. Days with relative humidity of 20 percent or less occurred in January, February, April, November, and December. The lowest relative humidity recorded during the year was 16 percent

on November 13. Average daily minimum relative humidity was higher than long-term averages throughout the spring and summer months.

Observed dew point temperatures ranged from 81.5 °F on June 8 to 5.7 °F on January 18. Wet bulb temperature ranged from 82.0 °F on June 8 to 14.5 °F on January 18.

Heat Stress

Restrictions on outdoor work due to excessive heat are based on values of the wet bulb globe temperature (WBGT) (WSRC, 1995). Hunter and Minyard (2000) provides a description of WBGT and the method used at SRS to calculate WBGT from standard meteorological measurements at CLM.

Monthly and annual maximum WBGT and statistics on heat stress category days for 2003 is summarized in Table 1(b). The highest WBGT for 2003 was 92.8 °F on June 30. Heat stress Category 5 days (WBGT > 90.0 °F) occurred on only 13 days during the summer of 2003. A total of 142 days reached at least Category 1 from April through November of the year. The number of occurrence days for each heat stress category in 2003 is considerably less than that for the previous several years.

Wind

Monthly average and extreme ground-level wind speed (CLM 4 meter level) for 2003 is summarized in Table 1(c). Daily averaged wind speed for the year are plotted in Fig. 13. Figures 14(a) and 14(b) show wind rose plots depicting joint occurrence frequencies of the indicated wind speed category by wind direction sector at the 61 meter level of the eight area towers. Fig. 15 provides wind rose plots for the 4 levels of measurement at CLM.

Seasonal wind rose plots for 2003 for data from the 61m level of CLM are shown in Fig. 16. Tables of the joint frequency data used to create the wind rose plots are given in Appendix A.

Wind speeds were strongest on average during the winter and spring months. The highest instantaneous wind speed recorded at the 4m level, 41.7 mph, was the result of a thunderstorm on May 3. A strong winter storm moving through the Southeast U. S. on February 23 produced the highest daily average wind speed of 11.2 mph.

Wind rose plots for the area towers show typical annual patterns for the 61 meter level. This pattern consists of higher frequencies of wind from the northeasterly sectors and southwest to westerly sectors. Due to the location of the D area tower in the shallow valley formed by the Savannah River, wind direction is more frequently from the southeasterly and northwesterly sectors than for the other area towers. Wind roses for CLM also show typical variations in the frequency patterns by level, with progressively higher frequencies of southeasterly winds and lower frequencies of northeasterly and southwesterly winds nearer the ground. Weber (2003) provides a complete description of the wind climatology at the CLM site.

Seasonal wind rose plots for the 61 meter level at CLM are indicative of the typical seasonal patterns observed at SRS and generally reflect features of the larger scale weather patterns described above.

Barometric Pressure

Annual and monthly average and extreme barometric pressure is summarized in Table 1(c). Daily average barometric

pressure is plotted in Fig. 17. The lowest daily average and 15-minute minimum barometric pressure, 992.1 and 984.4 mb, respectively, were associated with the winter storm of February 22-23. The highest daily average and 15-minute barometric pressure, 1020.2 and 1023.8 mb, respectively, were associated with strong polar high pressure that built over the Southeast U. S. December 20-21.

ranged from 28 ly/day on February 16 to 701 ly/day on June 21.

Solar Radiation

Annual and monthly averages and extremes of daily total solar radiation are summarized in Table 1(c). This table also provides estimated monthly and annual estimates of percent observed solar radiation relative to theoretical clear sky maxima as an indicator of relative cloudiness. The monthly theoretical values were estimated from tables published by Budyko (1974). Daily total solar radiation for 2003 is plotted in Fig. 18. The average daily values ranged from 236 langleys per day (ly/day) in December to 506 ly/day in June. The low value for daily average solar radiation in December is due to a low solar angle, as the percent of theoretical maximum for the month, 72%, implies December was characterized by ample sunshine. Individual daily extremes

References

Budyko, M. I., *Climate and Life*, Academic Press, New York, NY (1974).

Hunter, C. H., and C. O. Minyard, *Estimating Wet Bulb Globe Temperature Using Standard Meteorological Measurements*, American Meteorological Society 2nd Symposium on Environmental Applications, January 9-14, 2000, Long Beach, CA (2000).

National Oceanic and Atmospheric Administration (NOAA), *Climate Diagnostics Bulletin (January – December 2003)*, published electronically by month at www.cpc.ncep.noaa.gov, Climate Prediction Center, Camp Springs, MD(2003a).

NOAA, *Daily Weather Maps*, National Weather Service, Camp Springs, MD.(2003b)

Oliver, J. E. and R. W. Fairbridge, ed., *The Encyclopedia of Climatology*, Von Nostrand Reinhold, New York, NY (1987).

Parker, M. J. and R. P. Addis, *Meteorological Monitoring Program at the Savannah River Site*, WSRC-TR-93-0106, Westinghouse Savannah River Company (1993).

Parker, M. J. and A. B. Antonicelli, *Description of ATG's Rain History Table*, WSRC Interoffice Memorandum SRT-NTS-2003-00021, Westinghouse Savannah River Company (2003).

SRTC Nonproliferation Technologies Section, *Quality Assurance of Meteorological Data*, WSRC Procedure Manual 15.3, Meteorological Monitoring Procedures, NTSP T-113 (2002).

Weber, A. H., R. J. Kurzeja and R. L. Buckley, *Wind Climate Analysis for SRTC's Central Climatology Site*, WSRC-TR-2003-00141, Westinghouse Savannah River Company, Aiken, SC (2003).

Westinghouse Savannah River Company (WSRC), *The SRS Heat Stress Management Program*, Procedure Manual 4Q, Procedure 502, Revision 2 (1995).

Table 1(a) - Means and Extremes of SRS Meteorological Data for 2003

Month	Temperatures (°F)													Precipitation (in)							
	Average					Extremes				Number of Days				Total	Departure from 30yr avg	Rank (1952-2003)	Greatest in 24 Hrs	Date of 24hr max	No. of Days		
	Avg. Daily High	Avg. Daily Low	Month Avg.	Departure from 30yr avg	Rank (1968-2003)	Highest	High Date	Lowest	Low Date	Maximum Above 90 °F	Maximum Above 100 °F	Minimum Below 32 °F	Minimum Below 20 °F						Greater Than 0.01 in.	Greater Than 0.1 in.	Greater Than 0.5 in.
Jan	53.9	32.6	42.0	-4.1	6	70.7	9th	12.5	24th	0	0	15	3	1.73	-2.69	6	0.86	30th	5	4	1
Feb	59.3	38.2	47.5	-2.5	11	76.1	15th	27.9	11th	0	0	4	0	5.00	+0.65	21	1.28	16th	11	8	5
Mar	68.6	48.8	57.6	+0.3	15	79.9	29th	29.9	31st	0	0	2	0	7.09	+2.17	10	1.85	20th	14	9	5
Apr	72.8	51.2	61.6	-2.7	5	84.5	30th	31.9	1st	0	0	0	0	8.43	+5.08	1	3.50	7th	9	7	4
May	81.3	62.3	70.6	-1.4	11	89.6	10th	49.9	13th	0	0	0	0	5.57	+1.93	7	1.38	19th	10	8	4
Jun	86.4	66.8	75.2	-3.1	4	90.7	27th	55.1	2nd	1	0	0	0	10.99	+6.10	2	2.27	18th	13	11	8
Jul	87.1	70.5	77.3	-4.1	1	91.9	17th	66.3	24th	8	0	0	0	8.91	+3.27	6	2.36	2nd	16	12	6
Aug	87.8	71.2	77.7	-2.4	6	92.4	27th	68.2	9th	8	0	0	0	4.59	-0.36	27	0.81	1st	12	10	3
Sep	82.2	63.9	71.9	-3.1	5	89.3	4th	47.5	30th	0	0	0	0	2.70	-1.32	13	0.76	1st	10	7	1
Oct	75.5	54.6	63.7	-1.4	12	82.9	21st	43.6	16th	0	0	0	0	3.03	-0.08	19	1.34	28th	7	5	2
Nov	71.5	48.0	58.2	+1.5	12	84.0	5th	26.2	30th	0	0	2	0	1.21	-1.69	12	0.57	19th	7	3	1
Dec	56.0	32.6	42.9	-5.4	2	68.1	23rd	21.0	21st	0	0	16	0	1.93	-1.41	13	0.65	10th	5	4	2
Year	73.6	53.5	62.2	-2.4	1	92.4	27-Aug	12.5	24-Jan	17	0	39	3	61.18	+11.64	3	3.50	7-Apr	119	88	42



Rank by coolest



Rank by warmest



Rank by wettest



Rank by driest

Table 1(b) - Means and Extremes of SRS Meteorological Data for 2003

Month	Dew Point Temperature (°F)					Wet Bulb Temperature (°F)					Relative Humidity (%)					Wet Bulb Globe Temperature (°F)						
	Average	Highest	High Date	Lowest	Low Date	Average	Highest	High Date	Lowest	Low Date	Avg. Daily Maximum	Avg. Daily Minimum	Monthly	Lowest	Low Date	Highest	High Date	Number of Days				
																		Cat 1 and Above	Cat 2 and Above	Cat 3 and Above	Cat 4 and Above	Cat 5
Jan	28.4	59.7	1st	5.7	18th	37.2	60.6	1st	14.5	18th	83	36	60	20	10th	66.0	1st	0	0	0	0	0
Feb	36.5	64.7	22nd	15.1	8th	42.6	65.4	22nd	27.2	11th	91	45	70	20	13th	71.0	15th	0	0	0	0	0
Mar	47.9	67.6	20th	20.0	31st	52.5	69.1	20th	28.8	31st	91	52	74	21	25th	75.9	29th	0	0	0	0	0
Apr	49.8	68.8	7th	28.0	1st	55.2	69.0	7th	30.7	1st	91	45	70	20	13th	80.2	29th	3	0	0	0	0
May	61.7	72.2	18th	41.8	12th	65.2	74.7	10th	53.4	30th	91	51	75	26	12th	85.5	8th	22	10	2	0	0
Jun	65.6	81.5	8th	48.3	2nd	69.1	82.0	8th	52.6	2nd	93	51	75	33	1st	92.8	30th	29	24	18	7	2
Jul	69.5	78.6	27th	63.1	14th	72.1	79.8	27th	65.3	25th	90	60	78	49	9th	90.5	17th	29	27	26	16	5
Aug	68.4	76.6	25th	57.0	5th	71.5	78.6	16th	61.8	5th	87	55	74	49	23rd	91.4	24th	31	30	27	16	6
Sep	59.8	76.3	3rd	37.5	29th	64.6	78.3	3rd	43.2	30th	83	47	68	28	28th	88.8	2nd	21	10	6	2	0
Oct	51.8	72.7	14th	33.2	3rd	57.1	74.9	14th	39.3	3rd	83	47	68	25	22nd	81.1	14th	3	0	0	0	0
Nov	46.0	70.4	5th	16.1	14th	52.0	74.2	5th	24.0	30th	80	45	66	16	13th	85.3	4th	4	2	1	0	0
Dec	30.8	58.0	10th	13.5	21st	37.9	59.4	10th	19.0	21st	83	42	65	19	2nd	65.9	23rd	0	0	0	0	0
Year	51.4	81.5	8-Jun	5.7	18-Jan	56.4	82.0	8-Jun	14.5	18-Jan	87	48	70	16	13-Nov	92.8	30-Jun	142	103	80	41	13

Table 1(c) - Means and Extremes of SRS Meteorological Data for 2003 (cont'd)

Month	Wind Speed (mph)				Barometric Pressure (mb)					Solar Radiation (ly)						Degree Days					
	Monthly Average	Max 15-min Average	Max Instantaneous	Date Max Inst.	Average	Lowest	Low Date	Highest	High Date	Average Daily Total	% of Theoretical Max	Minimum Daily Total	Date	Maximum Daily Total	Date	Heating Degree Days	Daily maximum	Date	Cooling Degree Days	Daily Maximum	Date
Jan	4.9	16.5	32.6	23rd	1008.8	994.1	9th	1022.0	24th	256	0.71	67	30th	368	27th	710	42	24th	0	0	
Feb	4.7	17.2	38.5	23rd	1006.6	984.4	23rd	1016.4	19th	259	0.58	28	16th	463	23rd	489	32	17th	0	0	
Mar	4.2	15.0	36.9	20th	1003.6	991.0	18th	1016.1	31st	306	0.54	35	1st	597	31st	237	22	31st	7	4	29th
Apr	4.2	13.1	25.5	22nd	1005.4	991.7	26th	1018.9	1st	430	0.63	49	7th	661	23rd	127	20	10th	24	6	30th
May	4.3	17.5	41.7	3rd	1003.1	990.2	31st	1013.5	20th	436	0.58	98	22nd	678	12th	5	3	14th	176	14	9th
Jun	3.6	14.3	35.8	13th	1004.2	990.5	1st	1013.8	30th	506	0.64	188	7th	701	21st	0	0		307	14	27th
Jul	3.7	15.2	38.4	7th	1007.0	998.8	2nd	1014.8	26th	466	0.61	128	1st	630	9th	0	0		385	17	9th
Aug	3.1	11.7	27.4	2nd	1006.8	999.0	8th	1016.4	14th	438	0.62	261	12th	622	14th	0	0		396	17	27th
Sep	3.7	16.2	31.5	4th	1006.3	997.0	18th	1015.0	30th	426	0.70	116	7th	560	17th	8	5	30th	216	13	4th
Oct	3.4	15.9	31.4	15th	1005.9	992.7	14th	1016.5	31st	333	0.67	35	28th	506	3rd	76	8	16th	35	6	22nd
Nov	4.0	19.6	35.4	19th	1009.6	992.2	19th	1021.3	9th	271	0.68	78	7th	392	2nd	236	26	30th	32	9	6th
Dec	4.1	16.8	35.4	10th	1009.9	990.5	10th	1023.8	21st	236	0.72	34	4th	326	2nd	684	32	21st	0	0	
Year	4.0	19.6	41.7	3-May	1006.4	984.4	23-Feb	1023.8	21-Dec	364	0.64	28	16-Feb	701	21-Jun	2573	42	24-Jan	1578	17	27-Aug

Table 2. Monthly and Annual Average and Extreme Temperatures, 1973-2003

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1973	46.1	45.9	60.7	61.9	70.5	77.7	79.1	74.5	70.5	62.4	59.0	50.3	63.2
1974	59.6	50.8	62.2	66.2	75.3	77.5	81.5	80.9	75.3	64.5	56.6	49.0	66.6
1975	51.4	53.2	55.8	63.9	75.6	79.1	79.7	82.4	75.7	68.7	59.3	48.5	66.1
1976	44.2	55.7	61.5	64.8	68.9	75.6	80.4	78.0	73.1	60.1	48.7	44.8	63.0
1977	35.3	47.1	60.0	66.9	73.3	80.6	83.6	80.6	77.9	62.1	58.2	46.7	64.4
1978	39.3	41.3	54.2	65.7	70.9	79.7	82.1	81.2	77.1	65.6	60.7	49.6	64.0
1979	42.1	44.6	57.5	64.5	71.3	75.1	79.6	80.5	73.4	64.8	57.4	47.4	63.2
1980	45.9	44.3	52.6	63.5	71.2	78.3	83.8	82.5	79.2	62.7	52.8	46.0	63.6
1981	40.4	48.5	53.0	67.0	68.6	81.3	81.3	76.3	74.0	62.1	54.4	43.2	62.5
1982	43.0	50.0	58.9	62.4	75.7	78.8	80.9	80.1	75.0	66.2	58.7	54.8	65.4
1983	43.3	48.0	55.3	59.4	66.8	76.7	84.3	83.9	74.8	67.2	56.4	45.8	63.5
1984	45.0	51.7	56.5	62.6	71.9	80.1	80.1	80.8	74.0	73.4	53.4	56.9	65.5
1985	42.9	49.5	60.2	67.5	74.5	80.8	81.1	79.7	75.7	70.8	65.5	45.4	66.1
1986	45.4	54.6	57.9	66.4	74.4	82.7	86.9	80.1	78.4	67.1	61.3	49.3	67.0
1987	46.2	48.6	56.5	62.3	74.5	79.9	82.8	83.8	76.6	60.7	59.1	52.9	65.3
1988	42.3	47.8	56.8	64.2	70.4	76.8	81.6	81.4	75.4	61.2	58.0	49.1	63.8
1989	52.2	52.0	58.3	64.2	70.6	79.8	81.4	80.9	75.3	67.3	52.4	44.2	64.9
1990	54.9	57.5	60.0	64.0	72.9	80.5	83.7	83.8	79.0	69.4	59.9	54.6	68.4
1991	47.9	54.1	60.3	69.2	76.9	79.5	83.6	81.2	77.4	68.1	55.4	54.0	67.3
1992	49.5	54.1	57.2	65.0	71.2	78.9	83.7	80.7	76.9	65.0	57.1	48.0	65.6
1993	51.7	47.8	53.2	58.9	69.7	78.2	83.6	80.0	75.2	62.8	55.2	43.6	63.3
1994	41.5	50.1	60.2	68.0	71.2	82.3	81.8	81.2	77.4	67.2	62.3	53.3	66.4
1995	45.5	49.9	58.6	65.9	73.5	75.0	79.9	79.0	71.8	65.9	50.8	43.8	63.3
1996	44.6	50.1	50.6	61.6	72.9	76.5	79.3	76.0	72.7	62.1	51.6	48.8	62.2
1997	48.2	52.9	63.3	61.2	68.5	74.0	80.2	79.0	75.0	64.1	51.6	47.0	63.8
1998	49.7	51.1	53.6	62.7	74.6	82.1	82.6	80.3	75.8	66.9	60.5	53.6	66.1
1999	51.9	51.6	53.4	67.2	69.7	76.6	80.7	82.9	73.8	64.3	58.1	48.6	64.9
2000	44.4	50.2	58.5	60.7	75.1	78.0	79.9	77.6	71.7	62.5	53.1	38.2	62.5
2001	43.8	52.4	53.0	63.9	71.3	75.3	77.7	78.8	71.2	62.2	60.0	52.4	63.5
2002	47.3	48.0	57.6	68.1	70.2	77.5	80.5	78.4	75.4	66.7	51.7	44.5	63.8
2003	42.0	47.5	57.6	61.6	70.6	75.2	77.3	77.7	71.9	63.7	58.2	42.9	62.2

Avg	46.0	50.0	57.3	64.2	72.0	78.4	81.4	80.1	75.1	65.1	56.7	48.3	64.6
Lowest Mon	35.3	41.3	50.6	58.9	66.8	74.0	77.3	74.5	70.5	60.1	48.7	38.2	62.2
Yr Lowest	1977	1978	1971	1993	1983	1997	1967	1973	1973	1976	1976	2000	1996
Rec Low	-3	10	11	29	38	48	56	56	41	28	18	5	-3
Yr Rec	1985	1996	1980	1983	1989	1984	1963	1986	1967	1976	1970	1962	1985
Highest Mon	59.6	57.5	63.3	69.2	76.9	82.7	86.9	83.9	79.2	73.4	65.5	56.9	68.4
Yr Highest	1974	1990	1997	1991	1991	1986	1986	1983	1980	1984	1985	1971	1990
Rec High	86	86	90	99	102	105	107	107	104	96	89	82	107
Yr Rec	1975	1989	1974	1986	1963	1985	1986	1983	1990	1986	1987	1984	1986

Table 3. Monthly and Annual Rainfall, 1973-2003

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1973	5.50	4.47	6.67	4.55	4.91	12.97	6.86	3.90	4.38	1.72	0.98	3.99	60.90
1974	2.42	6.66	3.03	3.05	3.35	2.80	4.44	6.77	3.32	0.09	1.99	4.11	42.03
1975	4.98	6.64	5.92	4.42	5.15	3.83	8.55	3.83	5.18	1.74	3.41	2.03	55.68
1976	4.18	1.08	3.83	2.50	10.90	4.35	1.95	1.64	5.48	4.92	4.19	5.08	50.10
1977	3.72	1.62	6.86	1.27	1.79	2.47	3.42	7.30	5.50	4.27	1.63	3.86	43.71
1978	10.02	1.31	3.06	3.53	3.64	3.42	4.11	5.10	4.06	0.06	3.54	1.87	43.72
1979	3.59	7.74	3.09	6.49	8.94	1.54	7.85	2.12	6.13	1.35	3.95	2.17	54.96
1980	5.12	3.48	10.96	1.69	3.49	2.99	0.90	2.03	5.86	2.14	2.50	1.91	43.07
1981	0.89	5.02	4.72	2.07	6.90	4.29	3.96	5.79	0.54	2.81	1.00	9.55	47.54
1982	3.94	4.46	2.51	5.68	2.73	4.28	11.49	5.02	4.62	3.87	2.41	4.85	55.86
1983	3.75	7.22	6.62	5.77	1.67	6.57	4.85	6.32	3.56	1.92	5.39	4.15	57.79
1984	3.51	7.09	6.05	8.00	9.79	2.54	7.28	5.52	0.60	0.31	0.90	1.38	52.97
1985	3.01	6.92	1.31	0.84	1.70	4.62	8.10	4.38	0.49	6.34	6.36	2.48	46.55
1986	1.46	3.58	4.08	1.45	3.84	3.03	2.96	10.90	1.54	4.19	5.82	5.83	48.68
1987	7.39	7.55	4.97	0.70	3.57	5.64	4.87	4.93	3.56	0.29	2.74	1.42	47.63
1988	4.15	3.19	2.91	4.78	2.85	7.12	1.78	6.80	4.40	3.39	2.17	2.91	46.45
1989	1.42	3.59	5.52	4.89	2.60	6.67	11.46	3.27	4.87	3.36	3.00	4.41	55.06
1990	3.07	2.38	2.37	1.21	2.95	0.89	7.31	8.07	0.62	19.62	1.41	1.57	51.47
1991	7.03	1.84	7.89	4.73	3.06	2.17	7.89	9.26	4.40	0.99	1.55	3.32	54.13
1992	4.45	3.89	2.98	2.40	1.34	6.27	3.69	4.83	6.38	3.11	7.78	2.86	49.98
1993	7.45	3.62	8.37	1.74	1.43	3.27	3.12	2.23	7.29	0.99	1.87	1.81	43.19
1994	4.80	3.91	6.42	1.05	1.45	5.08	7.47	3.47	0.99	10.01	3.05	4.62	52.32
1995	6.96	7.97	0.92	1.28	1.77	8.15	5.71	6.92	5.75	2.64	2.38	4.47	54.92
1996	3.65	2.43	6.64	2.40	2.96	3.04	5.57	6.91	3.67	2.16	2.32	3.20	44.95
1997	4.20	5.45	2.69	4.38	2.38	6.90	7.09	2.01	4.89	4.08	5.51	9.09	58.67
1998	7.73	8.90	6.69	7.35	4.05	4.65	5.27	2.88	4.81	0.78	0.82	1.80	55.73
1999	5.31	2.29	3.44	1.95	1.26	7.52	4.91	3.14	4.46	2.57	1.50	1.21	39.56
2000	5.77	0.73	3.95	1.34	1.36	4.74	2.47	4.49	7.70	0.02	3.50	1.53	37.60
2001	3.11	2.68	7.21	1.28	3.85	6.49	4.79	3.55	3.33	0.50	1.03	0.54	38.36
2002	2.85	2.13	3.86	2.58	1.69	2.30	5.95	5.47	3.45	3.19	4.00	3.58	41.05
2003	1.73	5.00	7.09	8.43	5.57	10.99	8.91	4.59	2.70	3.03	1.21	1.93	61.18

Avg	4.42	4.35	4.92	3.35	3.64	4.89	5.64	4.95	4.02	3.11	2.90	3.34	49.54
Min	0.89	0.73	0.92	0.60	1.31	0.89	0.90	1.04	0.49	0.00	0.21	0.46	28.82
Yr Min	1981	2000	1995	1972	1965	1990	1980	1963	1985	1963	1958	1955	1954
Max	10.02	8.90	10.96	8.43	10.90	12.97	13.71	12.34	8.71	19.62	7.78	9.55	73.47
Yr Max	1978	1998	1980	2003	1976	1973	1971	1964	1959	1990	1992	1981	1964

Table 4 - SRS Rainfall (in inches) for 2003, Manual Gauges

Month	700-A	Barricade 2	Barricade 3	Barricade 5	100-C	400-D	200-F	200-H	100-K	100-L	100-P	SRTC
Jan	3.19	3.24	1.24	2.19	1.83	2.07	1.62	2.00	3.12	1.86	1.70	2.32
Feb	5.00	5.80	4.86	4.18	5.20	5.31	5.97	6.63	5.45	4.85	5.72	5.03
Mar	11.32	9.30	8.40	9.32	6.90	8.07	8.10	8.30	8.65	7.87	7.38	8.65
Apr	9.93	11.59	10.26	7.37	8.38	8.64	9.67	9.52	7.33	6.27	7.53	9.19
May	7.22	9.93	6.02	6.49	5.49	6.81	6.60	5.77	7.96	5.27	5.87	7.17
Jun	9.01	10.37	9.60	10.26	10.88	9.18	7.28	8.60	11.72	10.30	8.88	9.47
Jul	4.73	6.46	11.49	12.34	9.18	10.14	5.86	7.71	10.11	10.83	8.67	5.94
Aug	3.95	6.03	6.68	5.30	4.26	3.96	3.09	3.77	4.93	8.64	9.54	5.16
Sep	4.42	4.41	1.43	2.43	2.27	2.63	2.32	2.37	1.62	1.88	1.13	4.29
Oct	3.35	3.29	3.73	3.39	2.91	3.39	3.10	3.09	3.62	2.80	2.77	3.31
Nov	1.45	1.39	2.00	0.66	1.52	1.19	1.30	1.18	1.45	0.95	1.19	1.52
Dec	1.61	2.11	2.37	2.70	2.15	2.26	2.27	2.03	1.70	1.59	1.63	1.92
Annual	65.18	73.92	68.08	66.63	60.97	63.65	57.18	60.97	67.66	63.11	62.01	63.97

Fig. 1 SRS Meteorological Monitoring Network

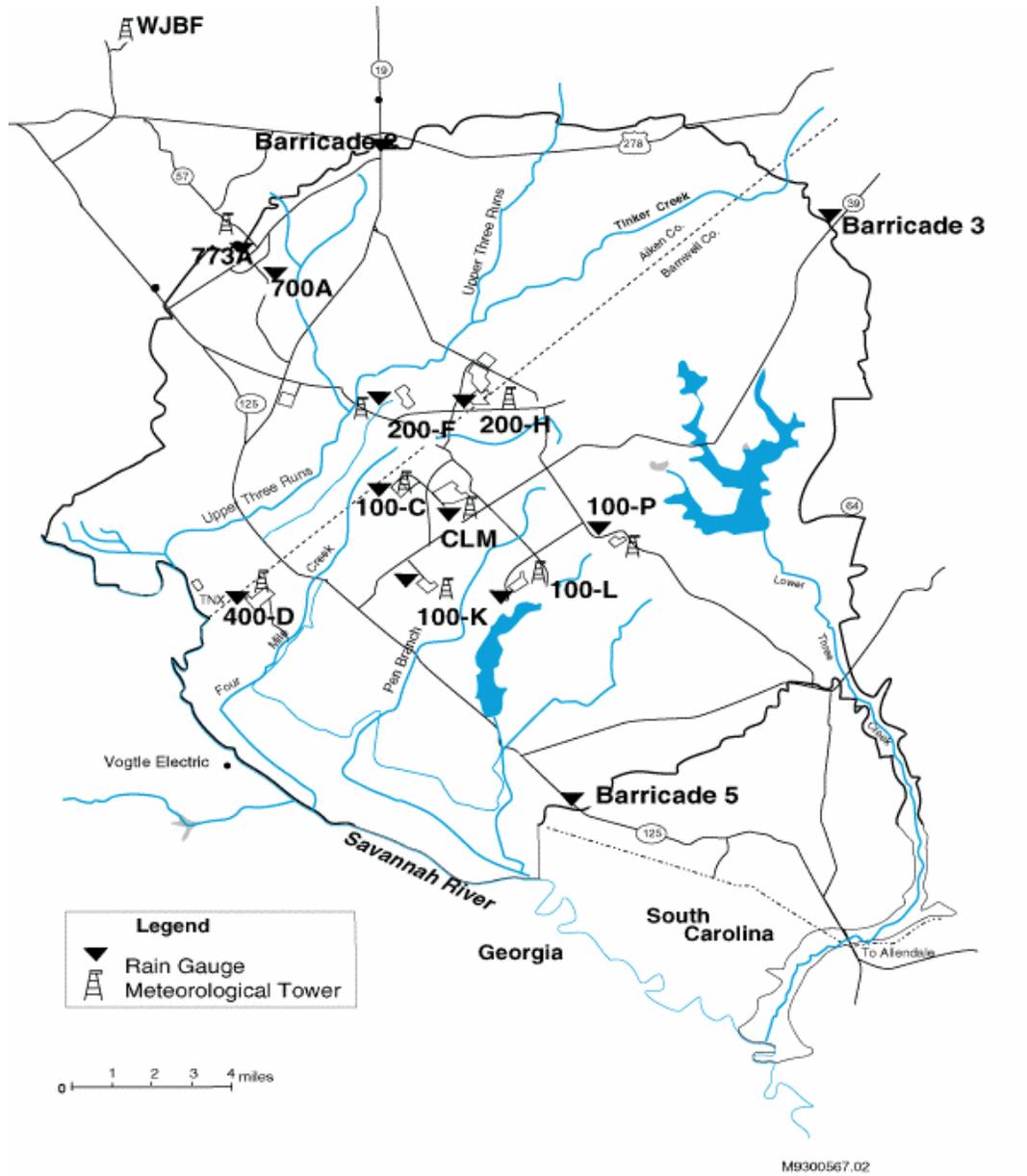


Fig. 2 - Summary of Daily Data for 2003

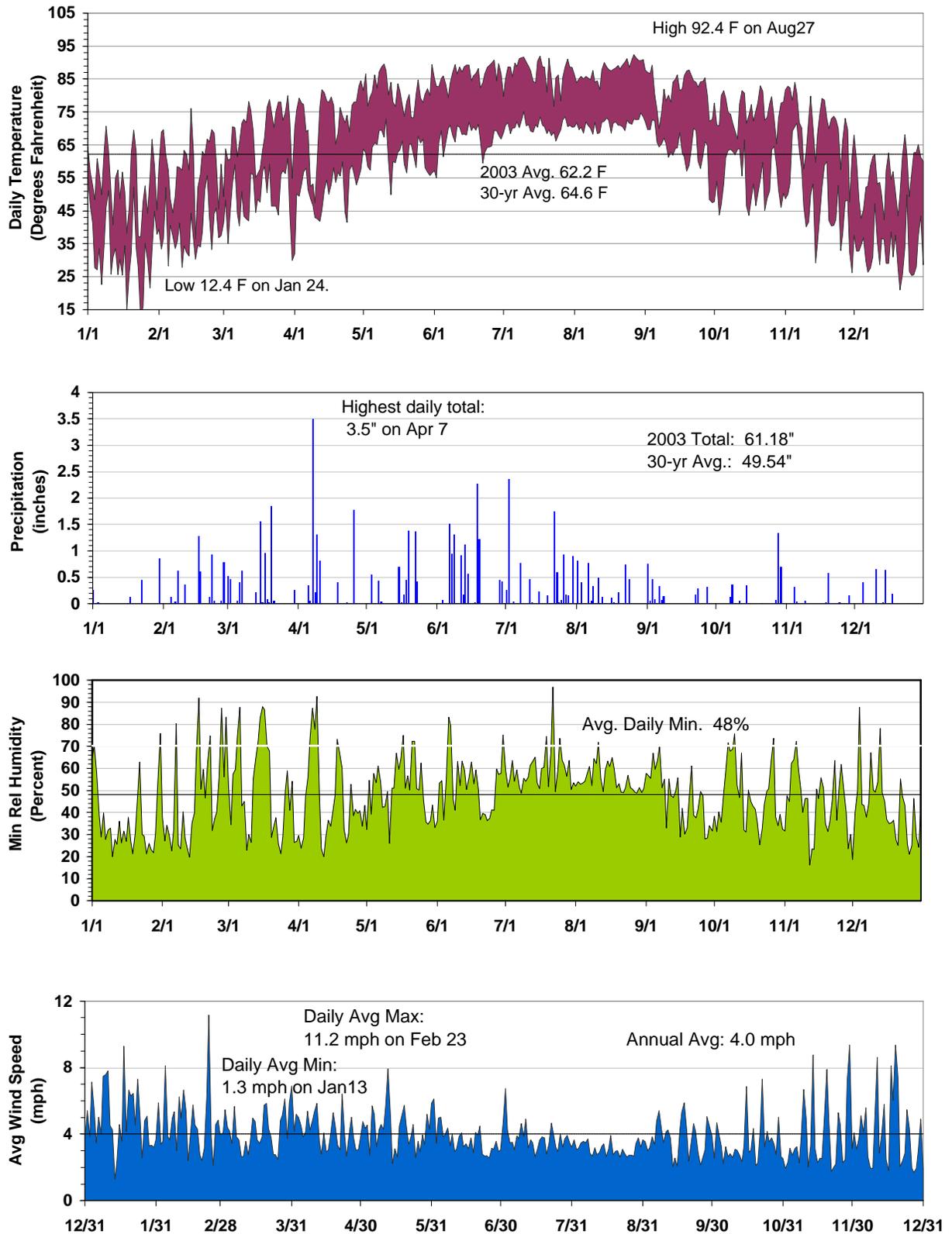


Fig. 3 - Daily High and Low Temperatures for 2003

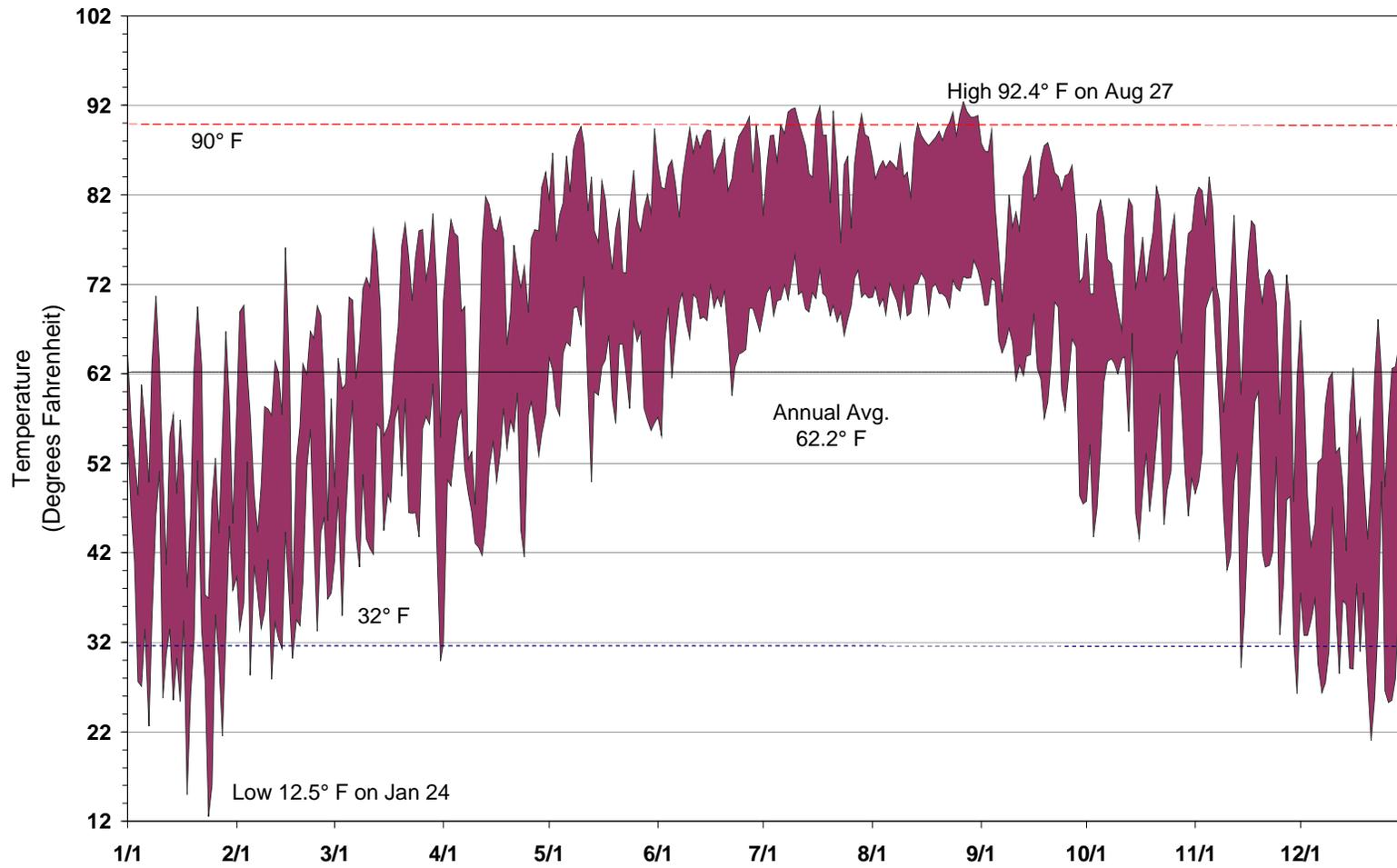


Fig. 4 - SRS Annual Average Temperature 1973-2003

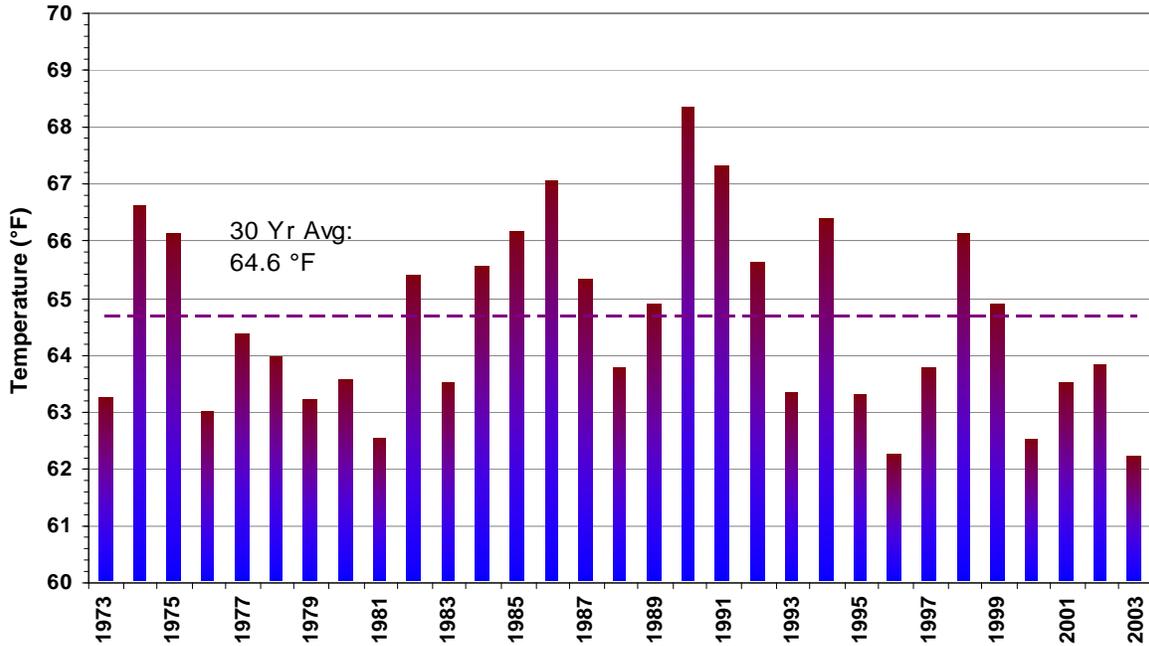


Fig. 5 - SRS Monthly Average Temperature

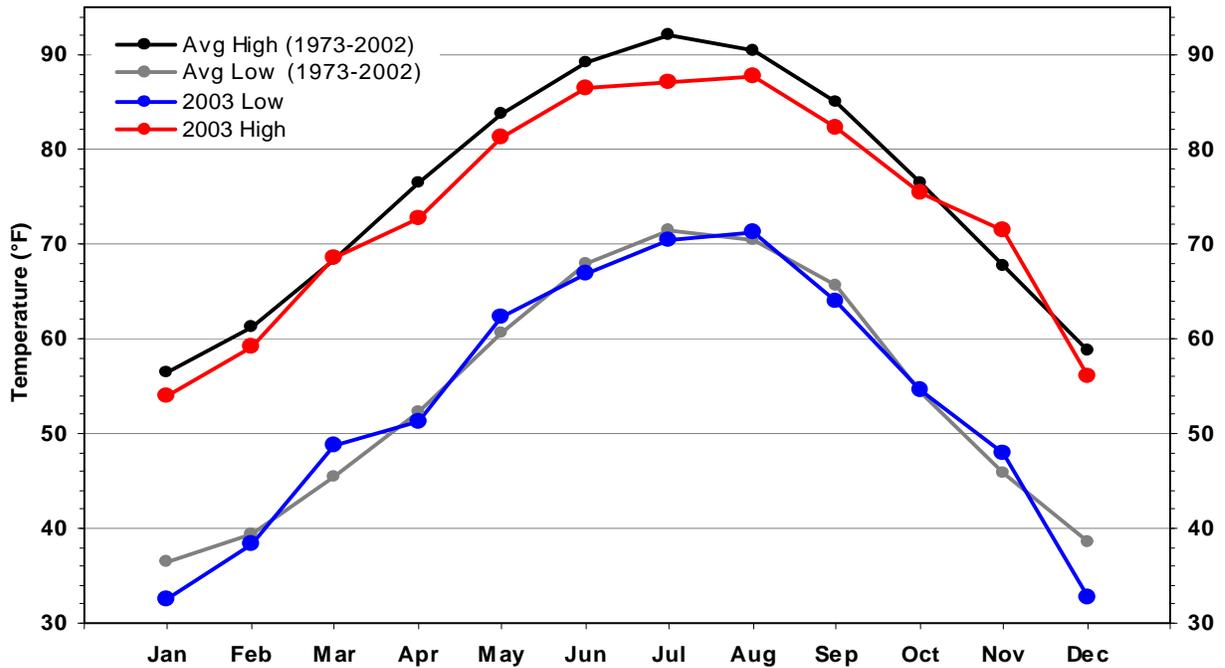
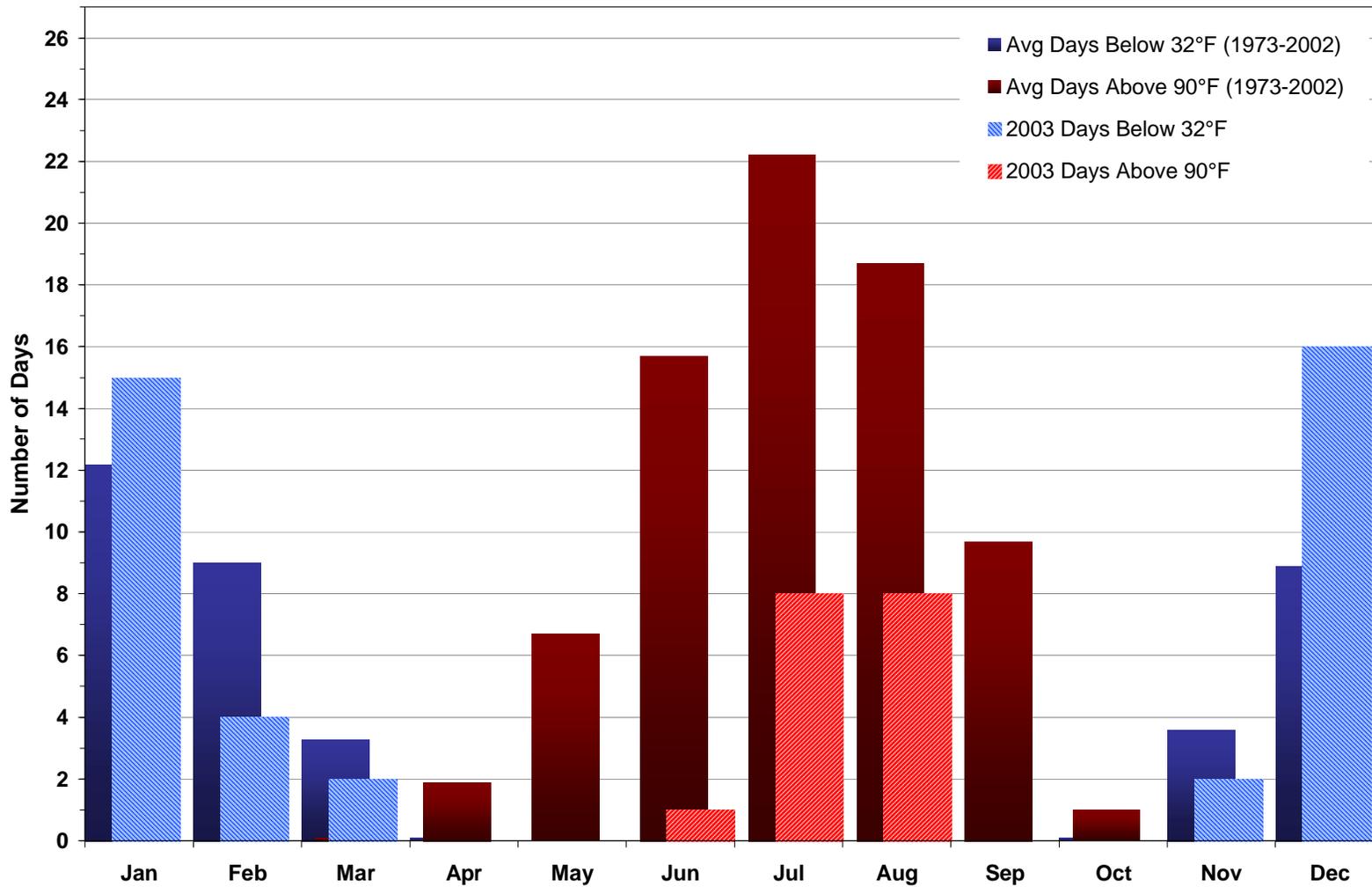


Fig. 6 - Number of Freezing (<32 F) and Sweltering (>90 F) Days



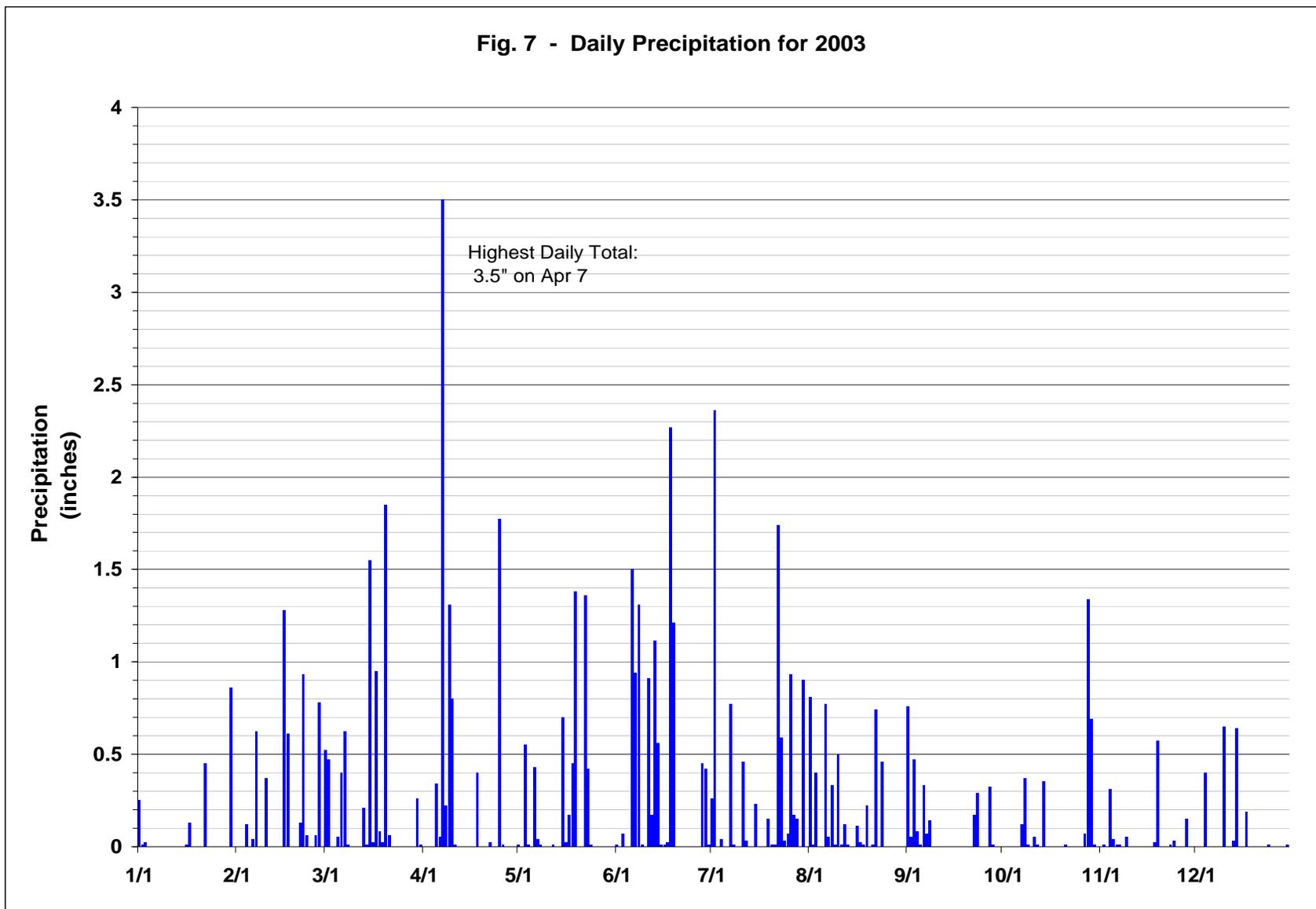


Fig. 8 - SRS Annual Precipitation 1973-2003

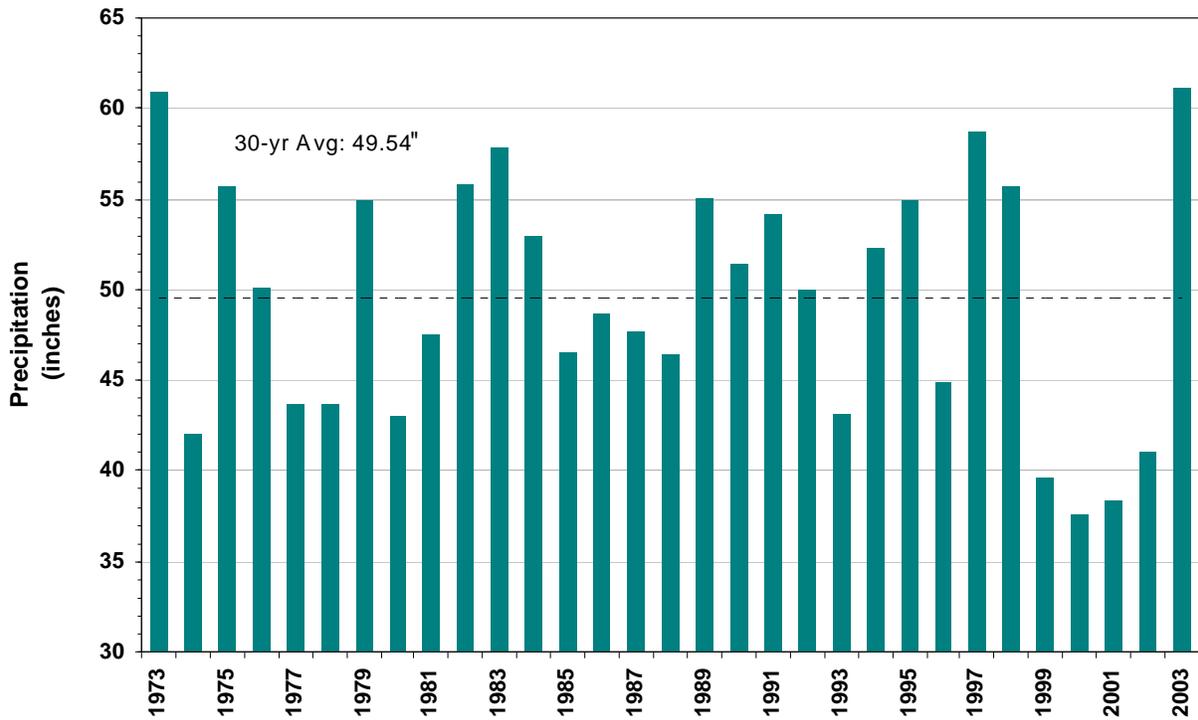


Fig. 9 - SRS Monthly Precipitation

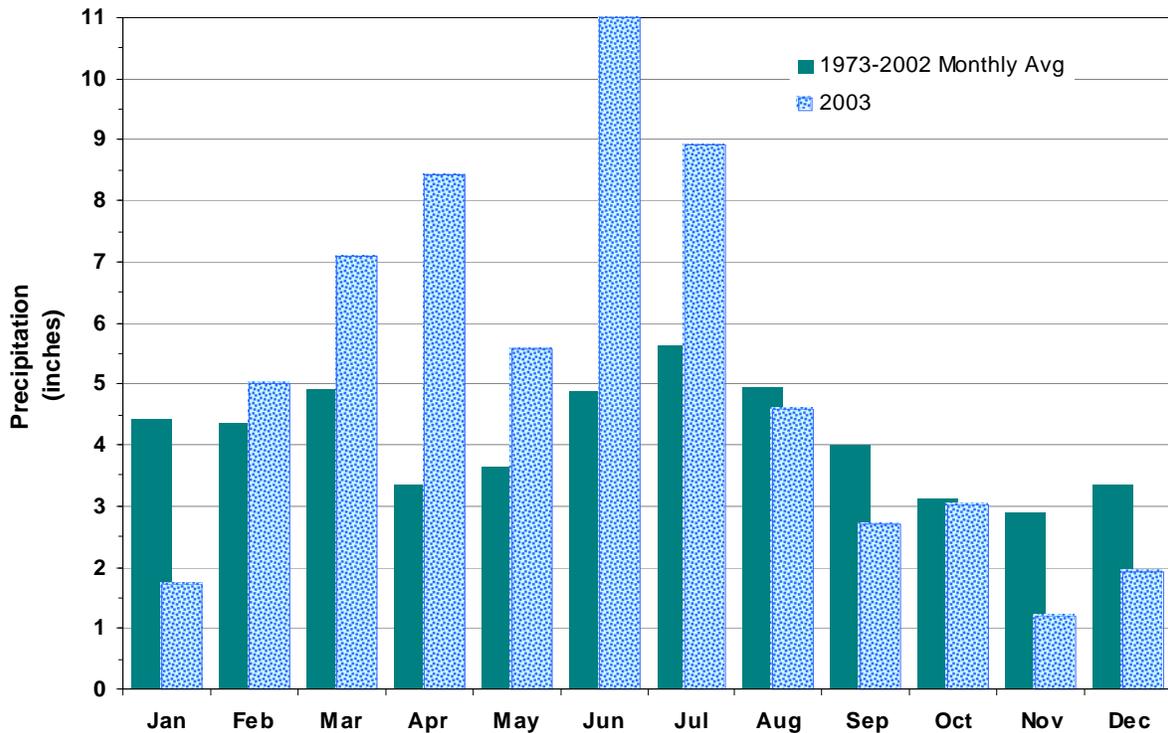


Fig. 10 - Daily High and Low Humidity for 2003

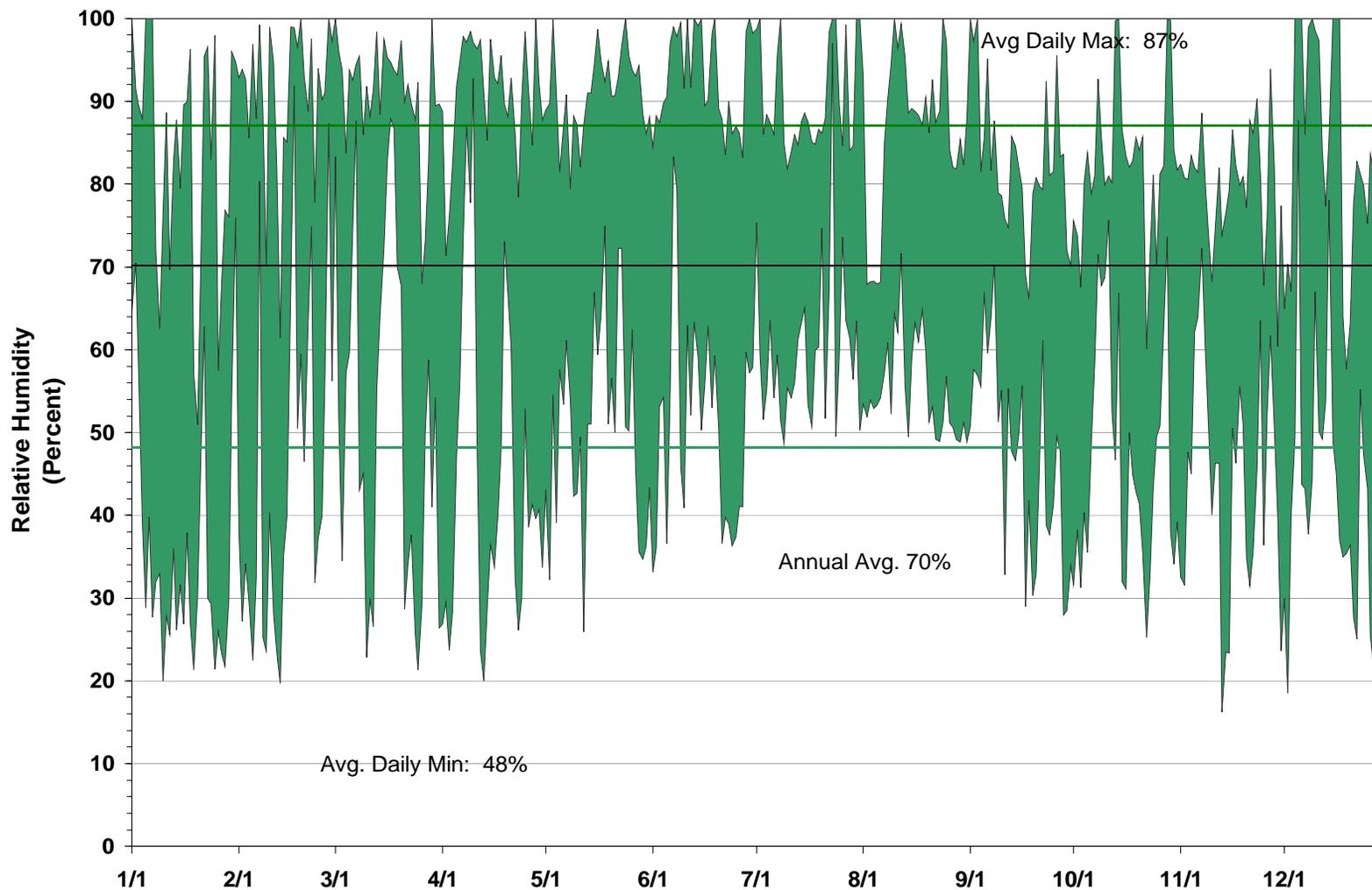


Fig. 11 - SRS Annual Average Humidity 1973-2003

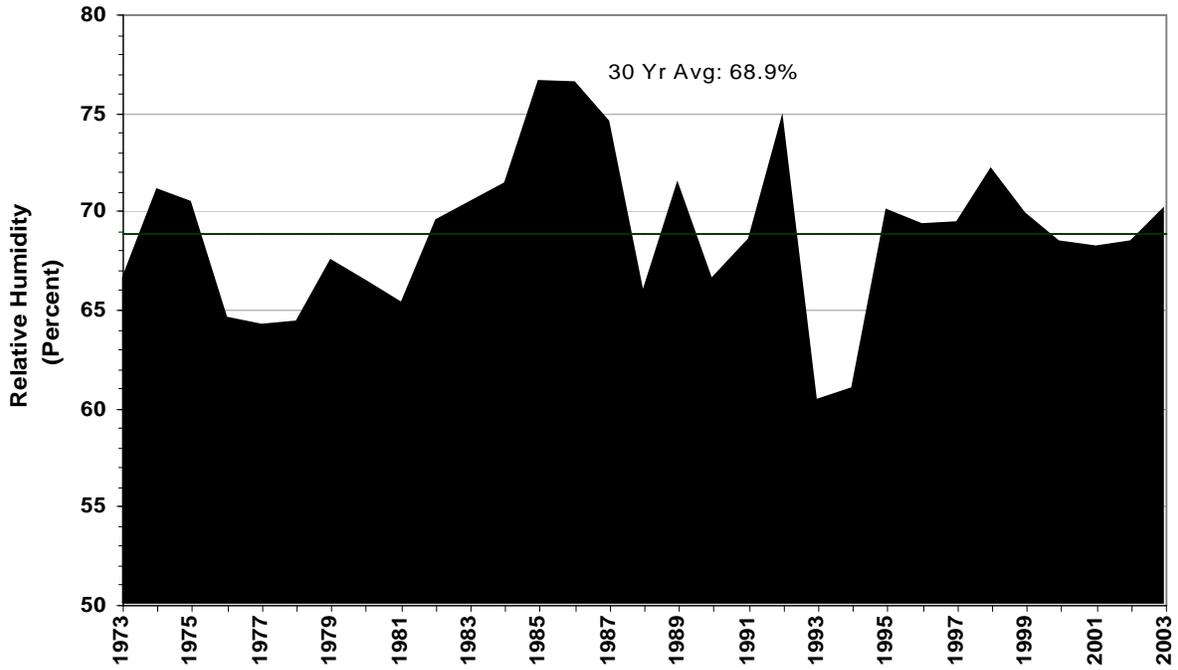


Fig. 12 - SRS Monthly Average Minimum Humidity

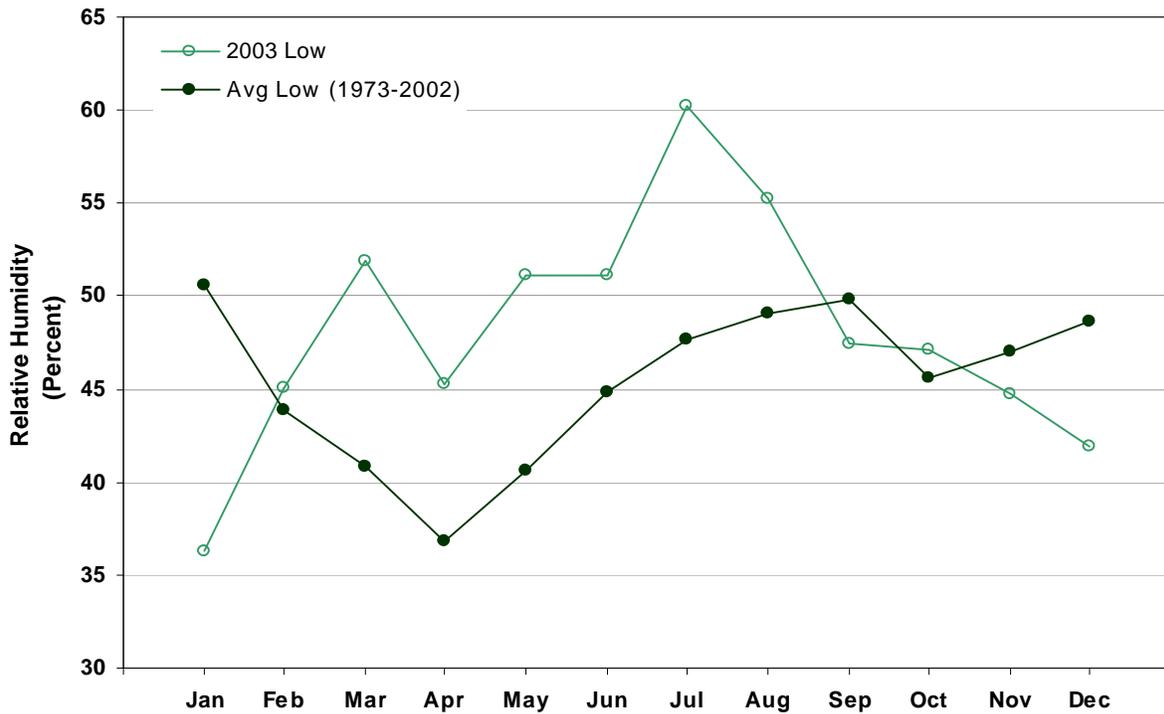


Fig. 13 - Daily Average Wind Speed for 2003

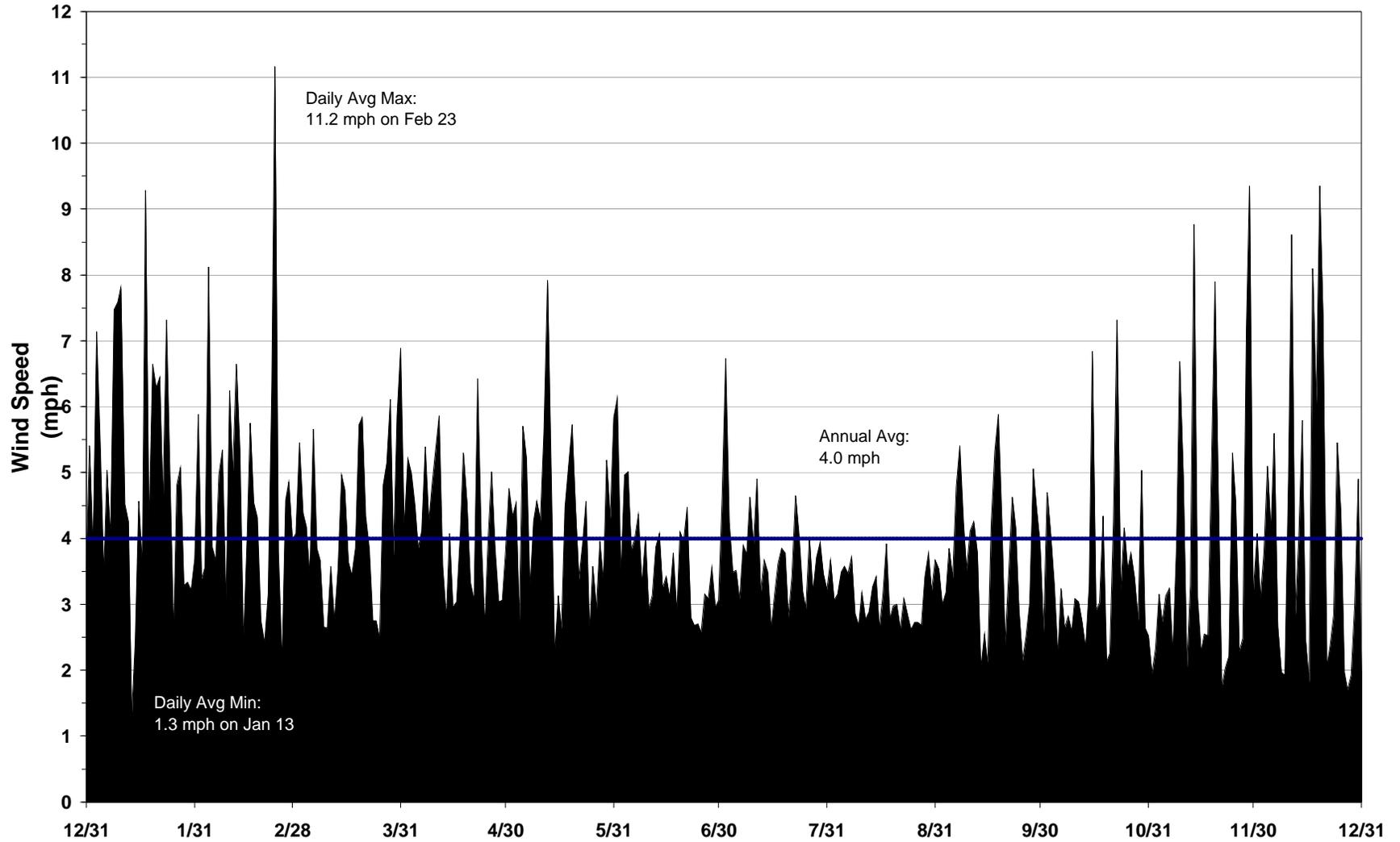
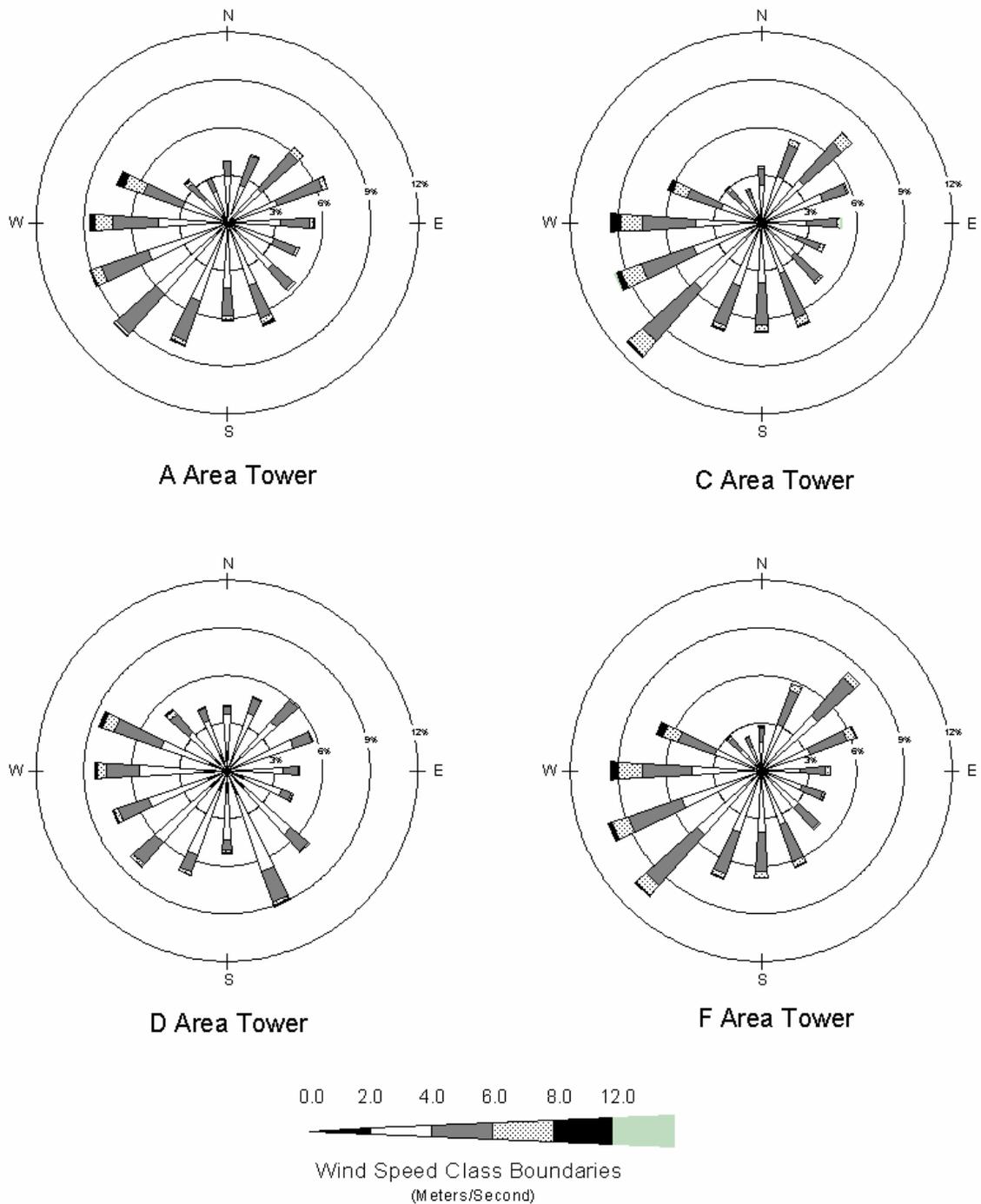
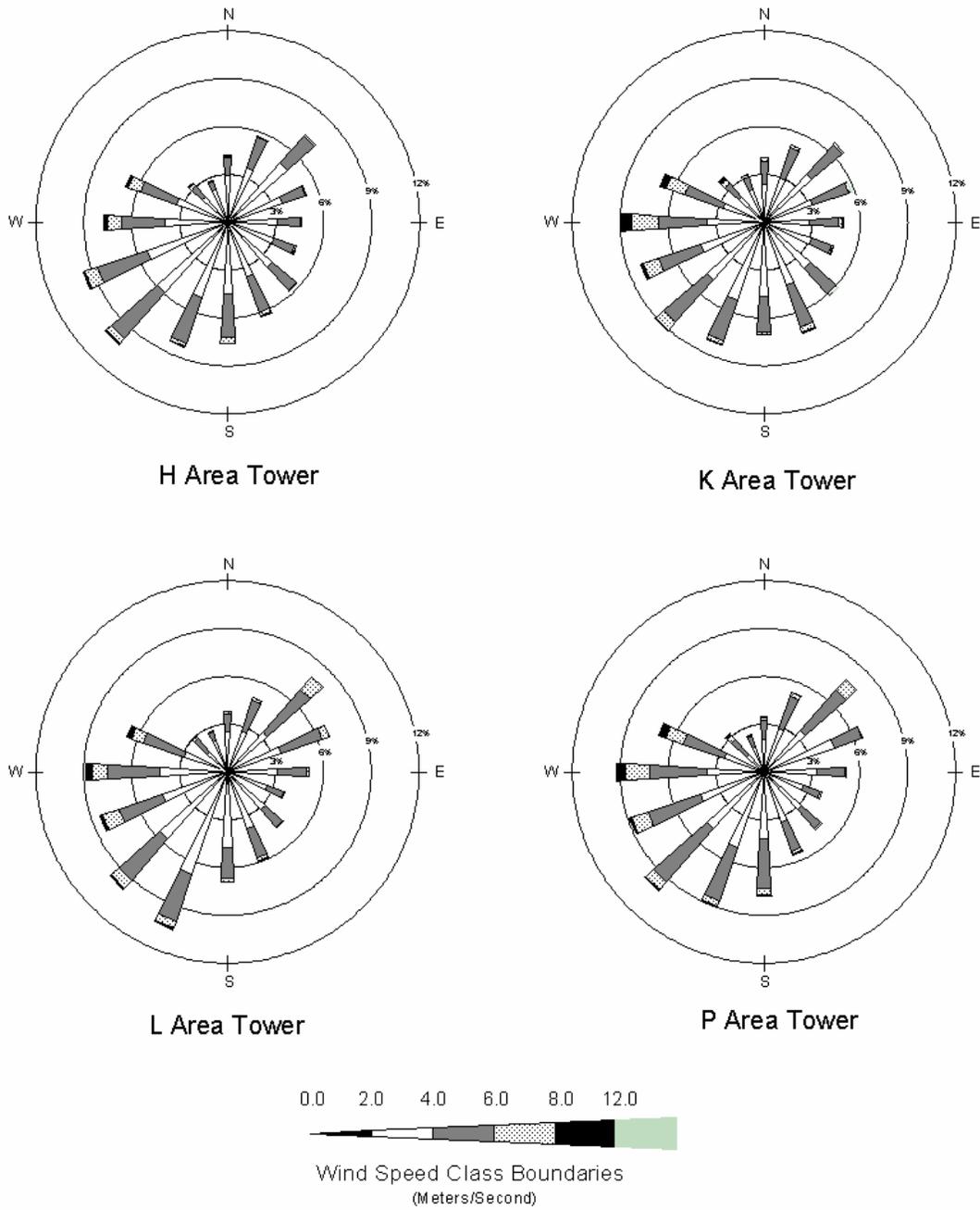


Fig. 14(a) - Annual Wind Rose Plots for 2003, 61-m Level



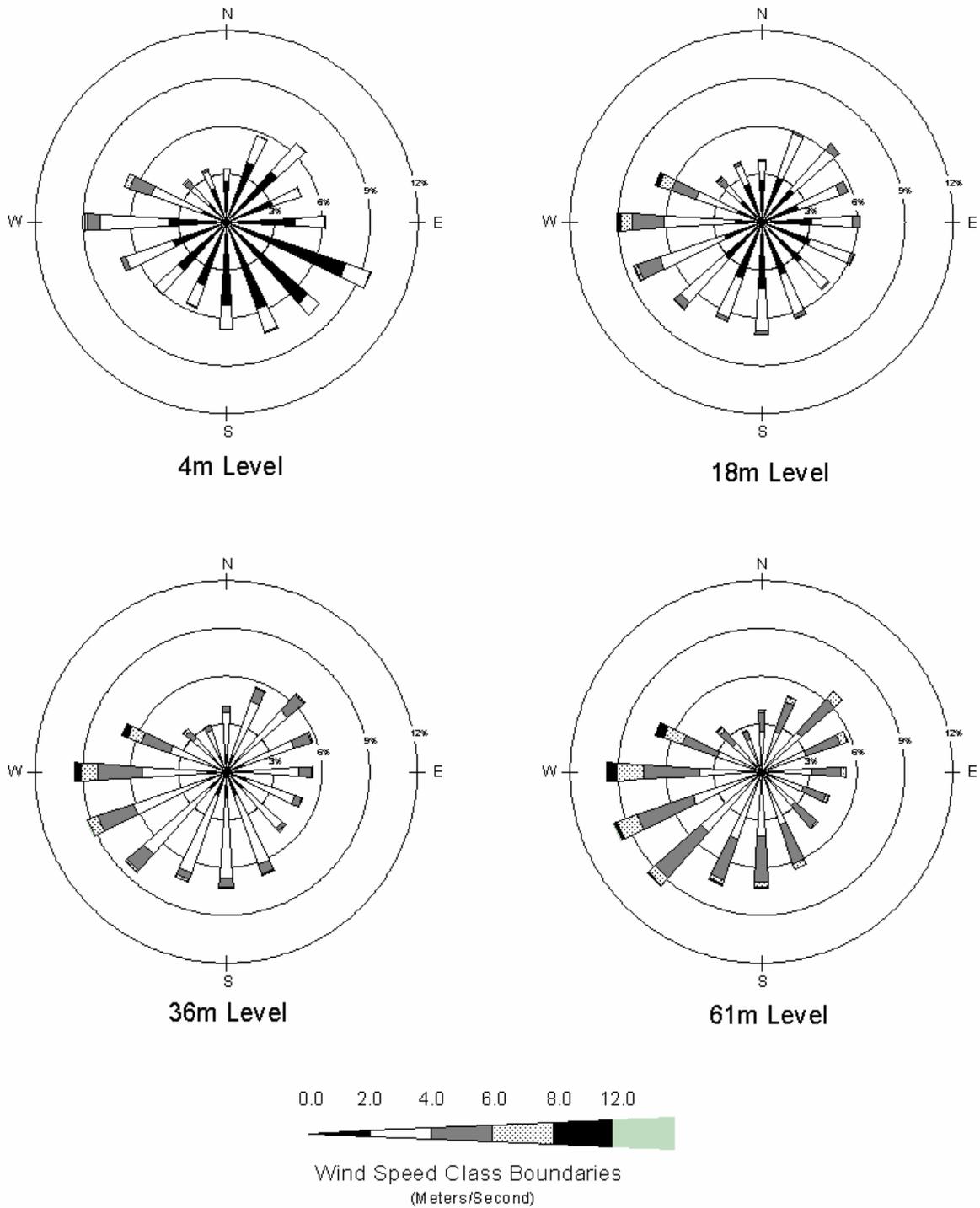
Wind rose plots depict the frequency of occurrence of wind direction sector (direction from which the wind blows) by wind speed category.

Fig. 14(b) - Annual Wind Rose Plots for 2003, 61-m Level



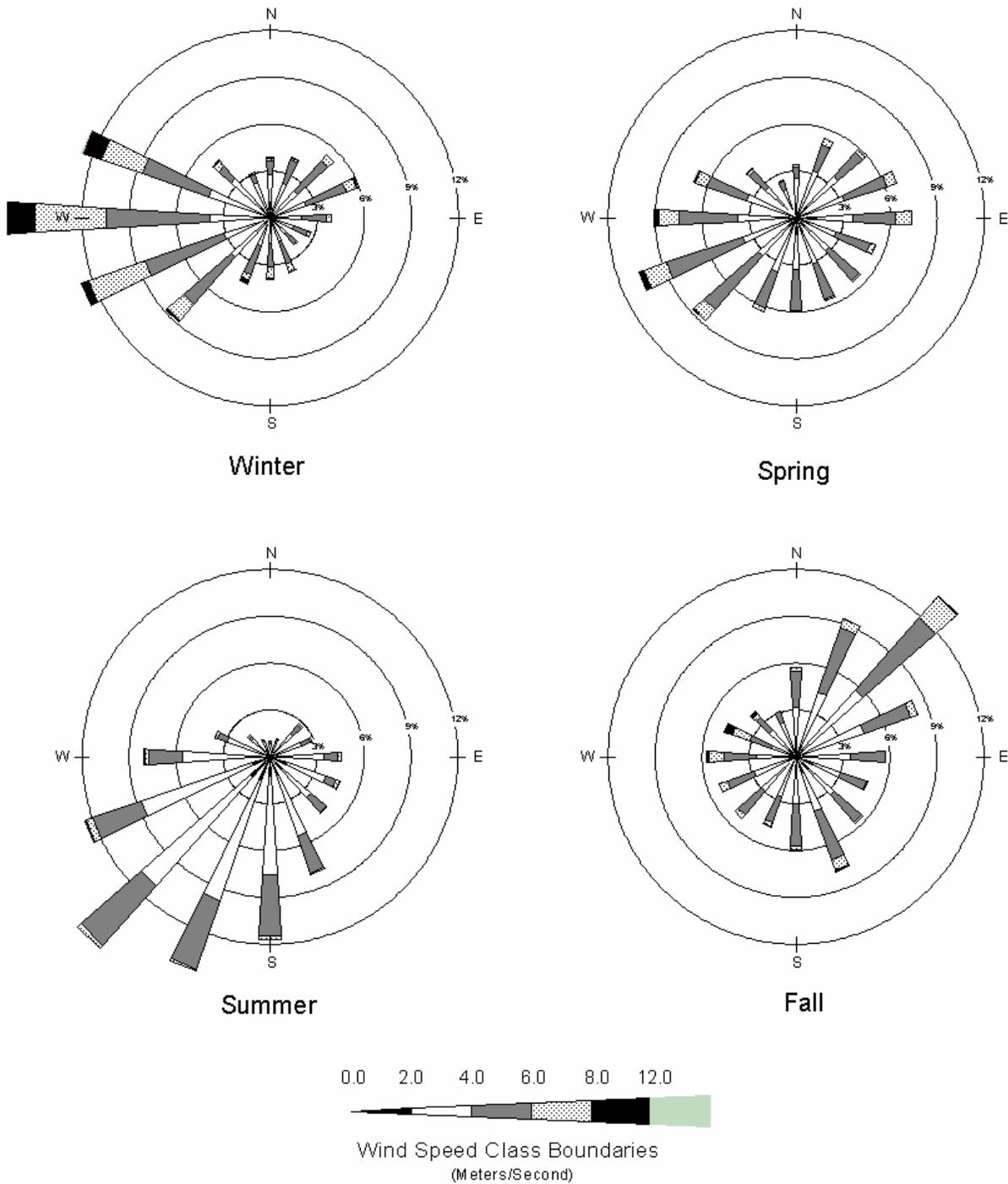
Wind rose plots depict the frequency of occurrence of wind direction sector (direction from which the wind blows) by wind speed category.

Fig. 15 - Annual Wind Rose Plots for 2003, Central Climatology, All Levels



Wind rose plots depict the frequency of occurrence of wind direction sector (direction from which the wind blows) by wind speed category.

Fig. 16 - Seasonal Wind Rose Plots for 2003, Central Climatology, 61-m Level



Wind rose plots depict the frequency of occurrence of wind direction sector (direction from which the wind blows) by wind speed category.

Fig. 17 - Daily Average Barometric Pressure for 2003

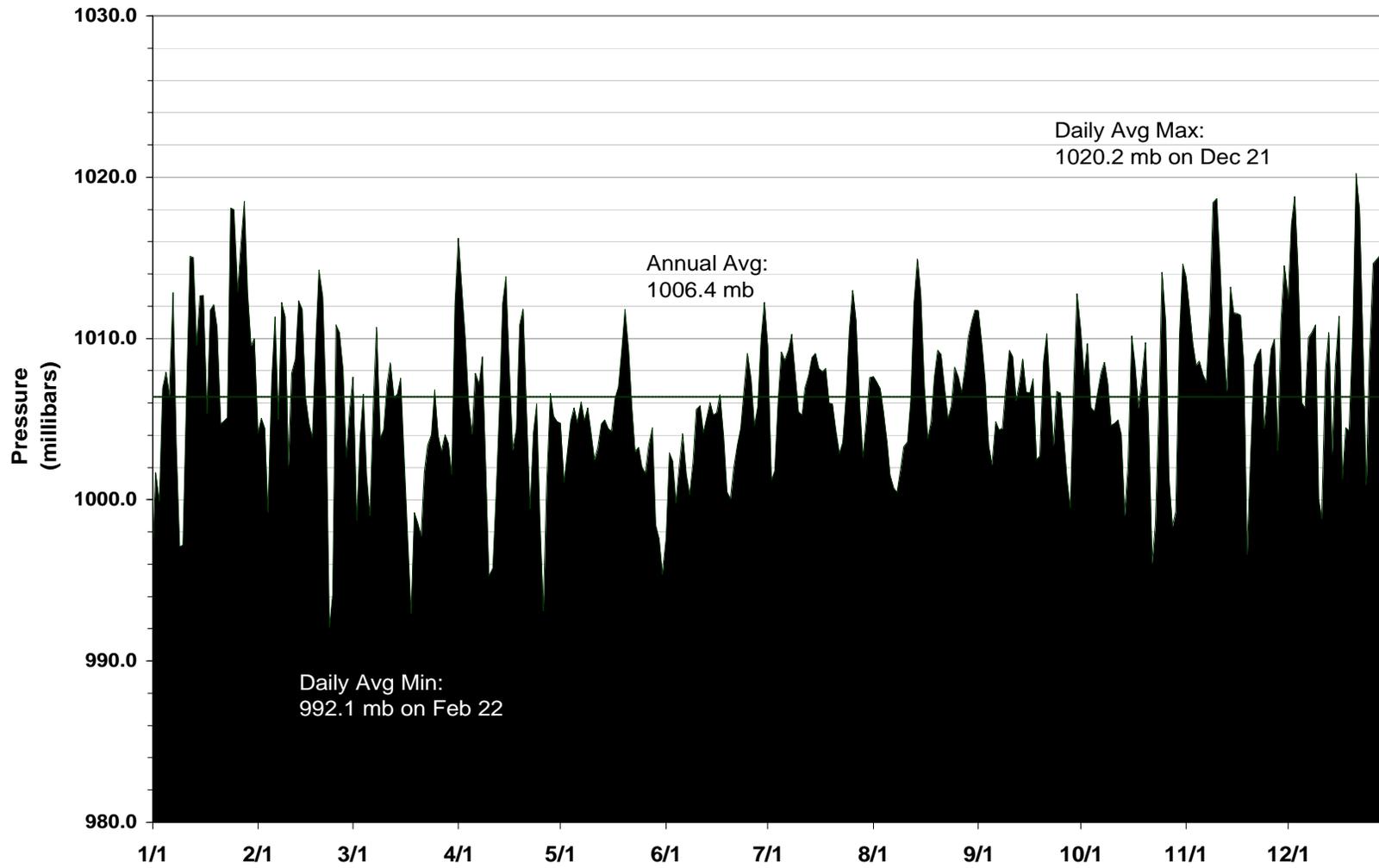
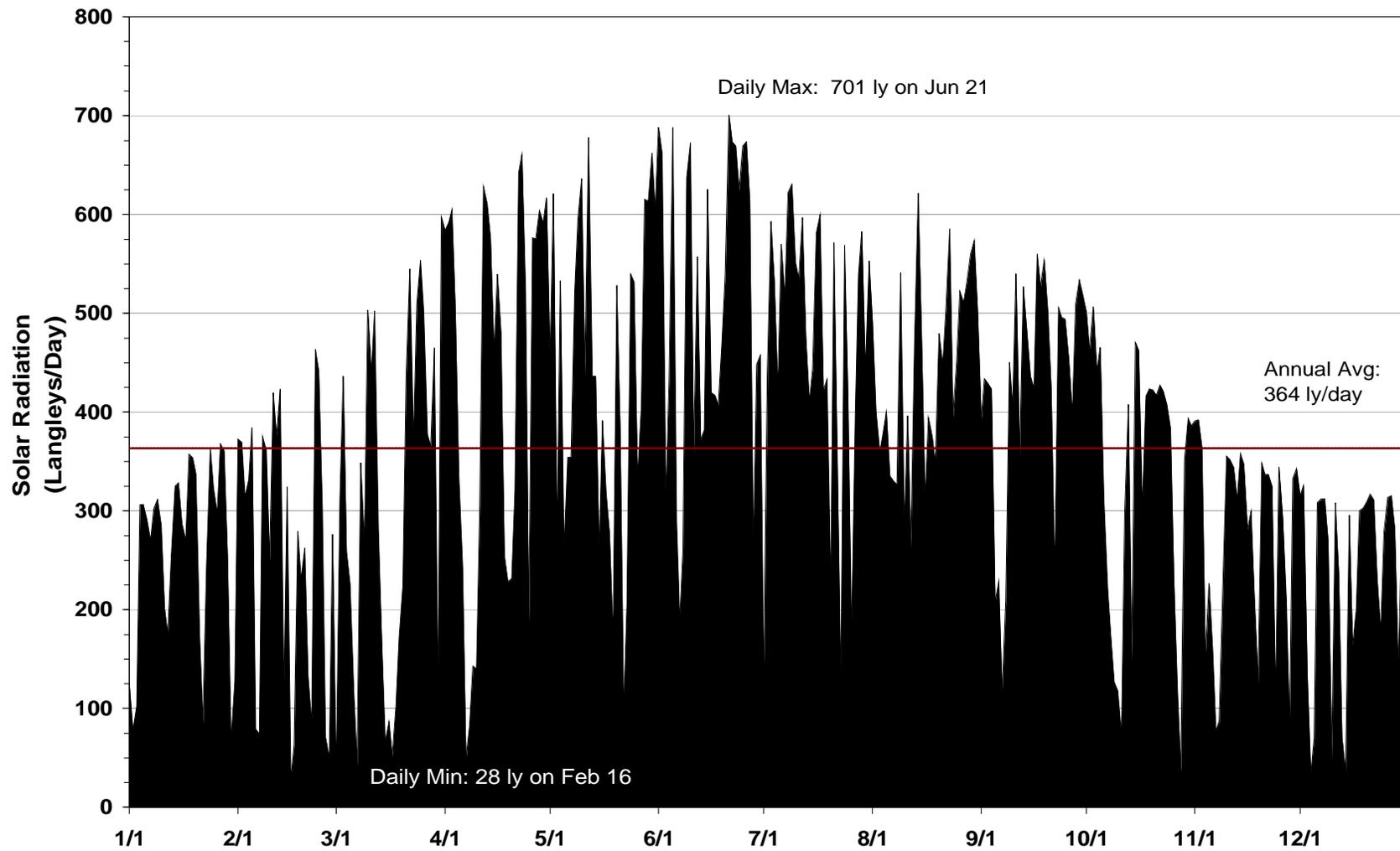


Fig. 18 - Daily Solar Radiation for 2003



**Table A.1 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the A Area Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00715	0.02265	0.00895	0.00037	0.00003	0.00000	0.03916
NNE	0.00561	0.01942	0.01971	0.00094	0.00000	0.00000	0.04568
NE	0.00501	0.02340	0.03075	0.00461	0.00006	0.00000	0.06381
ENE	0.00489	0.02834	0.03015	0.00329	0.00020	0.00000	0.06687
E	0.00549	0.02789	0.01833	0.00277	0.00020	0.00000	0.05468
ESE	0.00621	0.02477	0.01542	0.00123	0.00014	0.00003	0.04779
SE	0.00778	0.03052	0.01699	0.00169	0.00020	0.00003	0.05720
SSE	0.00827	0.03346	0.02159	0.00352	0.00132	0.00003	0.06819
S	0.00727	0.03392	0.01719	0.00249	0.00060	0.00000	0.06146
SSW	0.00801	0.04410	0.02646	0.00283	0.00032	0.00003	0.08174
SW	0.00972	0.04994	0.03289	0.00209	0.00020	0.00000	0.09484
WSW	0.00944	0.04299	0.03138	0.00646	0.00106	0.00003	0.09135
WSW	0.00755	0.03589	0.02897	0.01121	0.00312	0.00009	0.08683
WNW	0.00646	0.02345	0.02566	0.01284	0.00495	0.00003	0.07339
NW	0.00569	0.01424	0.01299	0.00246	0.00129	0.00000	0.03667
NNW	0.00626	0.01487	0.00847	0.00063	0.00011	0.00000	0.03035
Total	0.11080	0.46985	0.34587	0.05943	0.01379	0.00026	1.00000

**Table A.2 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the C Area Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00514	0.01879	0.01002	0.00154	0.00023	0.00000	0.03572
NNE	0.00725	0.02350	0.02161	0.00297	0.00003	0.00000	0.05536
NE	0.00654	0.02929	0.03161	0.00822	0.00034	0.00000	0.07600
ENE	0.00691	0.03378	0.01616	0.00100	0.00000	0.00000	0.05784
E	0.00540	0.02313	0.01867	0.00288	0.00009	0.00003	0.05019
ESE	0.00568	0.01836	0.01508	0.00286	0.00017	0.00003	0.04217
SE	0.00620	0.02207	0.02096	0.00208	0.00006	0.00000	0.05136
SSE	0.00745	0.02661	0.02952	0.00474	0.00086	0.00003	0.06921
S	0.00782	0.02958	0.02684	0.00394	0.00054	0.00000	0.06872
SSW	0.00834	0.03372	0.02627	0.00300	0.00066	0.00000	0.07198
SW	0.00908	0.04662	0.04411	0.01185	0.00126	0.00011	0.11303
WSW	0.00765	0.03749	0.03472	0.01336	0.00403	0.00026	0.09750
WSW	0.00765	0.03363	0.03400	0.01296	0.00660	0.00029	0.09513
WNW	0.00622	0.02044	0.02284	0.00931	0.00351	0.00000	0.06233
NW	0.00491	0.01245	0.01056	0.00194	0.00103	0.00000	0.03089
NNW	0.00488	0.01173	0.00537	0.00054	0.00006	0.00000	0.02258
Total	0.10712	0.42117	0.36833	0.08319	0.01944	0.00074	1.00000

**Table A.3 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the D Area Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.01273	0.02329	0.00457	0.00040	0.00003	0.00000	0.04101
NNE	0.00905	0.02948	0.01033	0.00049	0.00000	0.00000	0.04934
NE	0.00796	0.03328	0.01829	0.00117	0.00000	0.00000	0.06070
ENE	0.00876	0.03527	0.01244	0.00069	0.00000	0.00000	0.05716
E	0.01025	0.02474	0.00956	0.00074	0.00000	0.00003	0.04532
ESE	0.01187	0.02429	0.00694	0.00089	0.00011	0.00000	0.04409
SE	0.01515	0.03867	0.01433	0.00077	0.00014	0.00006	0.06912
SSE	0.01607	0.05117	0.01995	0.00231	0.00103	0.00003	0.09055
S	0.01393	0.02948	0.00622	0.00191	0.00103	0.00000	0.05257
SSW	0.01333	0.04292	0.01124	0.00206	0.00037	0.00000	0.06992
SW	0.01416	0.04652	0.01812	0.00188	0.00029	0.00000	0.08096
WSW	0.01267	0.03941	0.02018	0.00305	0.00094	0.00000	0.07626
WSW	0.01416	0.04070	0.02120	0.00591	0.00103	0.00000	0.08299
WNW	0.01187	0.03194	0.03102	0.00782	0.00243	0.00000	0.08508
NW	0.01065	0.02175	0.01507	0.00345	0.00134	0.00003	0.05228
NNW	0.01079	0.02255	0.00825	0.00089	0.00017	0.00000	0.04264
Total	0.19338	0.53545	0.22771	0.03442	0.00890	0.00014	1.00000

**Table A.4 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the F Area Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00474	0.01373	0.00813	0.00140	0.00026	0.00000	0.02826
NNE	0.00679	0.02435	0.02272	0.00437	0.00011	0.00000	0.05834
NE	0.00714	0.03987	0.03125	0.00420	0.00020	0.00000	0.08265
ENE	0.00651	0.02554	0.02500	0.00579	0.00071	0.00000	0.06356
E	0.00554	0.01921	0.01595	0.00308	0.00011	0.00003	0.04392
ESE	0.00642	0.02095	0.01364	0.00151	0.00029	0.00006	0.04287
SE	0.00656	0.02446	0.01775	0.00109	0.00003	0.00000	0.04989
SSE	0.00711	0.02903	0.02409	0.00357	0.00086	0.00006	0.06470
S	0.00659	0.03188	0.02526	0.00363	0.00057	0.00000	0.06793
SSW	0.00862	0.03251	0.02740	0.00300	0.00100	0.00000	0.07252
SW	0.00905	0.04504	0.04278	0.00816	0.00097	0.00003	0.10603
WSW	0.01005	0.04307	0.03511	0.01133	0.00191	0.00006	0.10152
WSW	0.00891	0.03479	0.03148	0.01487	0.00480	0.00026	0.09510
WNW	0.00731	0.02338	0.02446	0.01022	0.00428	0.00000	0.06964
NW	0.00571	0.01196	0.00959	0.00174	0.00106	0.00000	0.03005
NNW	0.00468	0.01127	0.00651	0.00049	0.00009	0.00000	0.02303
Total	0.11171	0.43102	0.36112	0.07843	0.01724	0.00049	1.00001

**Table A.5 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the H Area Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00714	0.02192	0.01159	0.00094	0.00023	0.00000	0.04181
NNE	0.00674	0.02917	0.02032	0.00077	0.00000	0.00000	0.05700
NE	0.00833	0.04116	0.02255	0.00111	0.00003	0.00000	0.07318
ENE	0.00731	0.02917	0.01507	0.00060	0.00000	0.00000	0.05214
E	0.00648	0.02472	0.01379	0.00083	0.00000	0.00003	0.04584
ESE	0.00662	0.02389	0.01390	0.00103	0.00020	0.00000	0.04564
SE	0.00876	0.02860	0.01966	0.00051	0.00009	0.00000	0.05762
SSE	0.00742	0.02868	0.02377	0.00228	0.00074	0.00000	0.06290
S	0.00782	0.03673	0.02788	0.00334	0.00046	0.00000	0.07623
SSW	0.00853	0.04176	0.02980	0.00228	0.00069	0.00000	0.08305
SW	0.00828	0.05086	0.03819	0.00445	0.00069	0.00000	0.10246
WSW	0.00813	0.04509	0.03276	0.00856	0.00111	0.00006	0.09572
WSW	0.00645	0.03311	0.02729	0.00848	0.00263	0.00000	0.07795
WNW	0.00716	0.02714	0.02340	0.00805	0.00197	0.00000	0.06773
NW	0.00591	0.01530	0.00899	0.00206	0.00063	0.00000	0.03288
NNW	0.00608	0.01595	0.00514	0.00063	0.00006	0.00000	0.02786
Total	0.11716	0.49324	0.33409	0.04592	0.00951	0.00009	1.00000

**Table A.6 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the K Area Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00505	0.01891	0.01446	0.00187	0.00017	0.00000	0.04046
NNE	0.00505	0.02433	0.02029	0.00158	0.00000	0.00000	0.05125
NE	0.00669	0.03354	0.02459	0.00158	0.00003	0.00000	0.06643
ENE	0.00594	0.02660	0.02327	0.00212	0.00009	0.00003	0.05805
E	0.00539	0.02313	0.01842	0.00244	0.00006	0.00003	0.04947
ESE	0.00729	0.02376	0.01352	0.00132	0.00020	0.00003	0.04611
SE	0.00786	0.03030	0.02175	0.00161	0.00003	0.00003	0.06158
SSE	0.00760	0.03406	0.02801	0.00307	0.00078	0.00003	0.07354
S	0.00792	0.03831	0.02258	0.00189	0.00014	0.00000	0.07084
SSW	0.00947	0.04247	0.02683	0.00250	0.00023	0.00000	0.08149
SW	0.00809	0.04006	0.03564	0.00654	0.00089	0.00000	0.09122
WSW	0.00720	0.03458	0.02778	0.01042	0.00155	0.00000	0.08152
WSW	0.00697	0.02884	0.03044	0.01659	0.00628	0.00009	0.08921
WNW	0.00557	0.02135	0.02562	0.01188	0.00465	0.00006	0.06912
NW	0.00620	0.01512	0.01145	0.00353	0.00138	0.00006	0.03773
NNW	0.00542	0.01613	0.00824	0.00181	0.00040	0.00000	0.03199
Total	0.10772	0.45147	0.35287	0.07073	0.01687	0.00035	1.00000

**Table A.7 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the L Area Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00654	0.01910	0.01116	0.00106	0.00003	0.00000	0.03788
NNE	0.00468	0.02215	0.02089	0.00194	0.00006	0.00000	0.04972
NE	0.00522	0.02820	0.03548	0.01093	0.00020	0.00000	0.08004
ENE	0.00568	0.03020	0.02680	0.00468	0.00014	0.00000	0.06751
E	0.00617	0.02489	0.01824	0.00154	0.00003	0.00006	0.05092
ESE	0.00668	0.01972	0.01085	0.00046	0.00009	0.00000	0.03779
SE	0.00748	0.02415	0.01436	0.00071	0.00003	0.00000	0.04673
SSE	0.00779	0.02963	0.01958	0.00211	0.00071	0.00000	0.05983
S	0.00762	0.04013	0.01864	0.00251	0.00054	0.00000	0.06945
SSW	0.00976	0.05832	0.03091	0.00405	0.00168	0.00000	0.10473
SW	0.00828	0.04807	0.03442	0.00651	0.00103	0.00006	0.09836
WSW	0.00702	0.03585	0.02857	0.01096	0.00234	0.00003	0.08478
WSW	0.00668	0.03579	0.03288	0.00942	0.00368	0.00009	0.08854
WNW	0.00520	0.02346	0.02706	0.00796	0.00291	0.00000	0.06659
NW	0.00417	0.01250	0.01119	0.00151	0.00060	0.00000	0.02997
NNW	0.00545	0.01547	0.00579	0.00037	0.00009	0.00000	0.02717
Total	0.10441	0.46763	0.34683	0.06674	0.01416	0.00023	1.00000

**Table A.8 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the P Area Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00374	0.01641	0.01216	0.00217	0.00009	0.00000	0.03456
NNE	0.00605	0.02249	0.02143	0.00271	0.00006	0.00000	0.05274
NE	0.00639	0.02803	0.03405	0.00882	0.00034	0.00000	0.07763
ENE	0.00893	0.03784	0.01807	0.00080	0.00000	0.00000	0.06564
E	0.00742	0.02557	0.01738	0.00128	0.00011	0.00000	0.05177
ESE	0.00648	0.01995	0.01082	0.00114	0.00014	0.00003	0.03856
SE	0.00802	0.02369	0.01578	0.00066	0.00009	0.00000	0.04823
SSE	0.00819	0.02543	0.01906	0.00203	0.00046	0.00000	0.05517
S	0.00856	0.03365	0.03091	0.00400	0.00086	0.00000	0.07797
SSW	0.00836	0.04152	0.03573	0.00328	0.00089	0.00000	0.08978
SW	0.00679	0.04075	0.04486	0.00645	0.00097	0.00000	0.09983
WSW	0.00662	0.03542	0.03453	0.01073	0.00154	0.00000	0.08884
WSW	0.00614	0.02920	0.03644	0.01513	0.00522	0.00017	0.09230
WNW	0.00494	0.02109	0.02731	0.01164	0.00491	0.00000	0.06989
NW	0.00351	0.01050	0.01293	0.00360	0.00186	0.00009	0.03248
NNW	0.00351	0.01281	0.00742	0.00080	0.00009	0.00000	0.02463
Total	0.10365	0.42434	0.37888	0.07523	0.01761	0.00029	1.00000

Table A.9 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 2m Level Central Climatology Tower, 2003

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.02581	0.00722	0.00037	0.00000	0.00000	0.00000	0.03341
NNE	0.03935	0.01770	0.00011	0.00003	0.00000	0.00000	0.05719
NE	0.04243	0.02359	0.00034	0.00000	0.00000	0.00000	0.06636
ENE	0.03072	0.01847	0.00049	0.00000	0.00000	0.00000	0.04968
E	0.04263	0.01859	0.00094	0.00003	0.00000	0.00000	0.06219
ESE	0.07926	0.01605	0.00049	0.00009	0.00000	0.00000	0.09588
SE	0.06790	0.00985	0.00011	0.00000	0.00000	0.00000	0.07787
SSE	0.05785	0.01502	0.00083	0.00009	0.00000	0.00000	0.07378
S	0.05237	0.01459	0.00060	0.00000	0.00000	0.00000	0.06756
SSW	0.04226	0.01408	0.00080	0.00000	0.00000	0.00000	0.05714
SW	0.04055	0.01956	0.00046	0.00000	0.00000	0.00000	0.06056
WSW	0.03569	0.03124	0.00326	0.00009	0.00003	0.00000	0.07030
WSW	0.03615	0.04277	0.00865	0.00106	0.00000	0.00000	0.08863
WNW	0.01608	0.03384	0.01448	0.00348	0.00000	0.00000	0.06787
NW	0.01511	0.01482	0.00503	0.00120	0.00003	0.00000	0.03618
NNW	0.02224	0.01165	0.00149	0.00003	0.00000	0.00000	0.03541
Total	0.64639	0.30903	0.03843	0.00608	0.00006	0.00000	1.00000

Table A.10 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 18m Level Central Climatology Tower, 2003

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.01048	0.02684	0.00377	0.00031	0.00003	0.00000	0.04143
NNE	0.01048	0.03669	0.00831	0.00046	0.00000	0.00000	0.05594
NE	0.01216	0.03932	0.01362	0.00100	0.00000	0.00000	0.06610
ENE	0.01194	0.03312	0.01151	0.00109	0.00000	0.00000	0.05765
E	0.01148	0.03426	0.00765	0.00106	0.00003	0.00000	0.05448
ESE	0.01422	0.03129	0.00474	0.00043	0.00006	0.00000	0.05074
SE	0.01445	0.03284	0.00266	0.00011	0.00000	0.00000	0.05005
SSE	0.01562	0.04583	0.00611	0.00077	0.00026	0.00000	0.06858
S	0.01633	0.05034	0.00574	0.00083	0.00000	0.00000	0.07324
SSW	0.01568	0.05105	0.00500	0.00129	0.00003	0.00000	0.07304
SW	0.01411	0.05476	0.01416	0.00123	0.00017	0.00000	0.08443
WSW	0.01228	0.04897	0.02416	0.00628	0.00106	0.00003	0.09277
WSW	0.01196	0.04120	0.02775	0.01042	0.00383	0.00000	0.09517
WNW	0.00865	0.02832	0.01944	0.00894	0.00400	0.00000	0.06935
NW	0.01222	0.01588	0.00600	0.00166	0.00057	0.00000	0.03632
NNW	0.01134	0.01613	0.00308	0.00014	0.00003	0.00000	0.03072
Total	0.20338	0.58684	0.16369	0.03601	0.01005	0.00003	1.00000

**Table A.11 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the 36m Level Central Climatology Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.01048	0.02684	0.00377	0.00031	0.00003	0.00000	0.04143
NNE	0.01048	0.03669	0.00831	0.00046	0.00000	0.00000	0.05594
NE	0.01216	0.03932	0.01362	0.00100	0.00000	0.00000	0.06610
ENE	0.01194	0.03312	0.01151	0.00109	0.00000	0.00000	0.05765
E	0.01148	0.03426	0.00765	0.00106	0.00003	0.00000	0.05448
ESE	0.01422	0.03129	0.00474	0.00043	0.00006	0.00000	0.05074
SE	0.01445	0.03284	0.00266	0.00011	0.00000	0.00000	0.05005
SSE	0.01562	0.04583	0.00611	0.00077	0.00026	0.00000	0.06858
S	0.01633	0.05034	0.00574	0.00083	0.00000	0.00000	0.07324
SSW	0.01568	0.05105	0.00500	0.00129	0.00003	0.00000	0.07304
SW	0.01411	0.05476	0.01416	0.00123	0.00017	0.00000	0.08443
WSW	0.01228	0.04897	0.02416	0.00628	0.00106	0.00003	0.09277
WSW	0.01196	0.04120	0.02775	0.01042	0.00383	0.00000	0.09517
WNW	0.00865	0.02832	0.01944	0.00894	0.00400	0.00000	0.06935
NW	0.01222	0.01588	0.00600	0.00166	0.00057	0.00000	0.03632
NNW	0.01134	0.01613	0.00308	0.00014	0.00003	0.00000	0.03072
Total	0.20338	0.58684	0.16369	0.03601	0.01005	0.00003	1.00000

**Table A.12 - Joint Occurrence Frequencies of Wind Direction Sector
by Wind Speed Category for the 61m Level Central Climatology Tower, 2003**

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00720	0.01833	0.01159	0.00191	0.00023	0.00000	0.03926
NNE	0.00508	0.02159	0.01979	0.00340	0.00009	0.00000	0.04994
NE	0.00714	0.02587	0.02855	0.00614	0.00026	0.00000	0.06796
ENE	0.00654	0.02321	0.02261	0.00500	0.00023	0.00000	0.05759
E	0.00848	0.02296	0.01825	0.00357	0.00003	0.00000	0.05328
ESE	0.00911	0.01893	0.01499	0.00217	0.00017	0.00000	0.04537
SE	0.00877	0.01976	0.01833	0.00063	0.00006	0.00000	0.04754
SSE	0.00971	0.02544	0.02590	0.00308	0.00043	0.00000	0.06456
S	0.00931	0.03109	0.02835	0.00348	0.00060	0.00000	0.07284
SSW	0.00908	0.03578	0.02695	0.00260	0.00074	0.00000	0.07515
SW	0.00891	0.04140	0.03832	0.00622	0.00049	0.00000	0.09534
WSW	0.00740	0.03803	0.03689	0.01348	0.00240	0.00006	0.09825
WSW	0.00765	0.03084	0.03541	0.01736	0.00574	0.00014	0.09714
WNW	0.00620	0.02264	0.02370	0.01248	0.00545	0.00003	0.07050
NW	0.00797	0.01596	0.01031	0.00246	0.00100	0.00000	0.03769
NNW	0.00648	0.01522	0.00531	0.00051	0.00009	0.00000	0.02761
Total	0.12500	0.40705	0.36525	0.08449	0.01799	0.00023	1.00000

Table A.13 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 61m Level Central Climatology Tower, Winter 2003

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.01030	0.01748	0.00891	0.00139	0.00093	0.00000	0.03901
NNE	0.00301	0.02083	0.01539	0.00151	0.00012	0.00000	0.04086
NE	0.00370	0.01933	0.02581	0.00498	0.00023	0.00000	0.05405
ENE	0.00370	0.02026	0.02720	0.00706	0.00081	0.00000	0.05903
E	0.00382	0.01586	0.01597	0.00324	0.00000	0.00000	0.03889
ESE	0.00347	0.01262	0.00903	0.00220	0.00000	0.00000	0.02732
SE	0.00440	0.00949	0.00857	0.00058	0.00000	0.00000	0.02303
SSE	0.00463	0.01157	0.01493	0.00544	0.00035	0.00000	0.03692
S	0.00417	0.01204	0.01505	0.00764	0.00069	0.00000	0.03958
SSW	0.00440	0.01435	0.01921	0.00405	0.00278	0.00000	0.04479
SW	0.00509	0.02847	0.04063	0.01308	0.00151	0.00000	0.08877
WSW	0.00451	0.02662	0.05313	0.03819	0.00498	0.00012	0.12755
WSW	0.00532	0.03333	0.06644	0.04502	0.02141	0.00093	0.17245
WNW	0.00613	0.03553	0.04491	0.02766	0.01285	0.00012	0.12720
NW	0.00914	0.02442	0.01088	0.00417	0.00104	0.00000	0.04965
NNW	0.00613	0.01794	0.00556	0.00104	0.00023	0.00000	0.03090
Total	0.08195	0.32014	0.38160	0.16725	0.04792	0.00116	1.00000

Table A.14 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 61m Level Central Climatology Tower, Spring 2003

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00476	0.02061	0.00702	0.00204	0.00000	0.00000	0.03442
NNE	0.00532	0.02661	0.01778	0.00419	0.00011	0.00000	0.05401
NE	0.01019	0.02570	0.02072	0.00215	0.00000	0.00000	0.05876
ENE	0.00691	0.02582	0.02842	0.00679	0.00011	0.00000	0.06805
E	0.01313	0.02299	0.02751	0.00996	0.00011	0.00000	0.07371
ESE	0.00872	0.01857	0.02299	0.00283	0.00034	0.00000	0.05344
SE	0.00725	0.02106	0.02559	0.00023	0.00011	0.00000	0.05423
SSE	0.01042	0.02095	0.02389	0.00091	0.00000	0.00000	0.05616
S	0.01053	0.02265	0.02638	0.00068	0.00000	0.00000	0.06024
SSW	0.00951	0.02695	0.02434	0.00272	0.00011	0.00000	0.06363
SW	0.00736	0.02491	0.04586	0.00940	0.00034	0.00000	0.08786
WSW	0.00634	0.03001	0.05106	0.01495	0.00385	0.00011	0.10632
WSW	0.00940	0.02763	0.03782	0.01257	0.00385	0.00000	0.09126
WNW	0.00645	0.02740	0.02638	0.00815	0.00113	0.00011	0.06963
NW	0.00770	0.01857	0.01404	0.00181	0.00034	0.00000	0.04246
NNW	0.00566	0.01393	0.00532	0.00079	0.00011	0.00000	0.02582
Total	0.12964	0.37432	0.40512	0.08016	0.01053	0.00023	1.00000

Table A.15 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 61m Level Central Climatology Tower, Summer 2003

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00408	0.00465	0.00113	0.00000	0.00000	0.00000	0.00986
NNE	0.00340	0.00635	0.00204	0.00045	0.00000	0.00000	0.01224
NE	0.00737	0.01213	0.00737	0.00102	0.00011	0.00000	0.02799
ENE	0.00635	0.01518	0.00589	0.00091	0.00000	0.00000	0.02833
E	0.00805	0.02663	0.00873	0.00261	0.00000	0.00000	0.04601
ESE	0.01167	0.02606	0.00714	0.00227	0.00034	0.00000	0.04748
SE	0.01099	0.02391	0.01292	0.00034	0.00000	0.00000	0.04816
SSE	0.01247	0.04113	0.02516	0.00068	0.00000	0.00000	0.07943
S	0.01269	0.06312	0.03887	0.00227	0.00023	0.00000	0.11717
SSW	0.01598	0.08147	0.04623	0.00147	0.00000	0.00000	0.14516
SW	0.01722	0.09303	0.05088	0.00283	0.00011	0.00000	0.16408
WSW	0.01179	0.07513	0.03286	0.00453	0.00068	0.00000	0.12499
WSW	0.01043	0.04555	0.02198	0.00238	0.00079	0.00000	0.08113
WNW	0.00635	0.02255	0.00691	0.00113	0.00023	0.00000	0.03717
NW	0.00793	0.00771	0.00215	0.00102	0.00011	0.00000	0.01892
NNW	0.00533	0.00567	0.00079	0.00011	0.00000	0.00000	0.01190
Total	0.15207	0.55025	0.27105	0.02402	0.00261	0.00000	1.00000

Table A.16 - Joint Occurrence Frequencies of Wind Direction Sector by Wind Speed Category for the 61m Level Central Climatology Tower, Fall 2003

Sector	Wind Speed Category, meters/sec						Total
	0-2	2-4	4-6	6-8	8-12	>12	
N	0.00802	0.02338	0.02361	0.00241	0.00000	0.00000	0.05742
NNE	0.00802	0.03564	0.04366	0.00573	0.00023	0.00000	0.09329
NE	0.00699	0.05042	0.06131	0.01822	0.00069	0.00000	0.13764
ENE	0.00860	0.03736	0.03140	0.00493	0.00012	0.00000	0.08240
E	0.00779	0.02693	0.02235	0.00012	0.00000	0.00000	0.05719
ESE	0.01169	0.01857	0.01708	0.00092	0.00000	0.00000	0.04825
SE	0.01158	0.02132	0.02315	0.00115	0.00012	0.00000	0.05730
SSE	0.01123	0.02533	0.03346	0.00642	0.00138	0.00000	0.07781
S	0.00951	0.02063	0.02705	0.00206	0.00126	0.00000	0.06051
SSW	0.00573	0.02166	0.01731	0.00264	0.00023	0.00000	0.04756
SW	0.00630	0.02304	0.02006	0.00287	0.00000	0.00000	0.05226
WSW	0.00619	0.02223	0.01799	0.00539	0.00023	0.00000	0.05203
WSW	0.00596	0.01902	0.02074	0.00963	0.00218	0.00000	0.05753
WNW	0.00619	0.01020	0.01478	0.01192	0.00539	0.00000	0.04847
NW	0.00722	0.01547	0.01135	0.00309	0.00229	0.00000	0.03942
NNW	0.00722	0.01616	0.00745	0.00012	0.00000	0.00000	0.03094
Total	0.12824	0.38735	0.39273	0.07759	0.01410	0.00000	1.00000